

92 00361

**DRAFT
SHORELINE PRESERVATION STRATEGY
FOR THE
SAN DIEGO REGION**

San Diego



ASSOCIATION OF
GOVERNMENTS



92 00 361

DRAFT SHORELINE PRESERVATION STRATEGY FOR THE SAN DIEGO REGION

SEPTEMBER 1991

San Diego



**ASSOCIATION OF
GOVERNMENTS**

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The following staff of SANDAG participated in the development of the report:

Stuart Shaffer, Deputy Executive Director
Steve Sachs, Senior Planner, Project Manager
Marney Cox, Special Services Director

In addition, Craig Everts, Moffat & Nichol Engineers, provided consultant services for the project.

ABSTRACT

TITLE: Draft Shoreline Preservation Strategy

AUTHOR: San Diego Association of Governments


SUBJECT: Recommended policies and actions to preserve and enhance the San Diego region's shoreline.

DATE: September 1991

LOCAL PLANNING AGENCY: San Diego Association of Governments
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San Diego, CA 92101

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ABSTRACT: The Shoreline Erosion Committee, SANDAG staff, and its consultant have prepared the Draft Shoreline Preservation Strategy. It was approved by the SANDAG Board of Directors for distribution and public review on September 27, 1991. The Strategy proposes an extensive beach building and maintenance program for the critical shoreline erosion problem areas in the region, as well as a number of actions to support this program, such as guidelines for shoreline land use and protective structures. The Strategy contains a comprehensive set of recommendations on the beach building program, and on financing and implementation.



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I EXECUTIVE SUMMARY

I

EXECUTIVE SUMMARY

The Region's Shoreline - A Valuable Resource in Trouble

The shoreline is a valuable asset to the environment and economy of the San Diego region and the State. It is also considered a resource of national significance. The beaches and seacliffs help define this area's quality of life; when we think of the region's positive image, we most often think of the climate and the shoreline.

Long time residents are aware that many of the area's beaches and seacliffs have been steadily eroding for the past decade. The Coast of California Study, a six-year, \$6 million scientific evaluation of the San Diego region shoreline conducted by the U.S. Army Corps of Engineers, documented the observations of local people about shoreline erosion and has projected trends of increasing beach loss and property damage in the future.

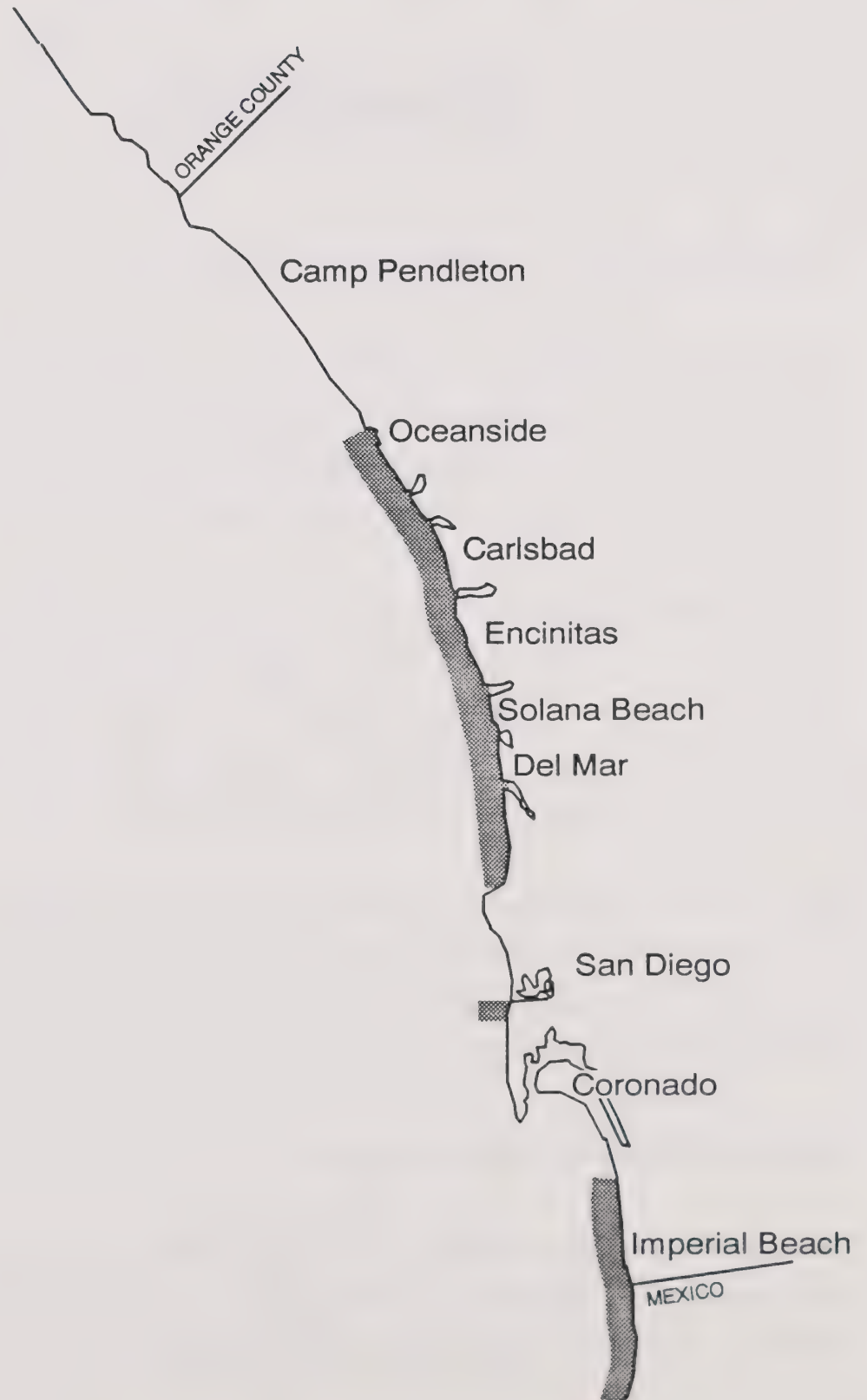
Figure 1 shows the critical shoreline problem areas in the region, including all or portions of each of the region's coastal cities: Imperial Beach, Coronado, San Diego, Del Mar, Solana Beach, Encinitas, Carlsbad and Oceanside. The problem areas also include stretches of shoreline owned and managed by state and federal agencies.

The Role of the Shoreline Preservation Strategy

The Shoreline Preservation Strategy is the San Diego region's response to the concerns about erosion voiced by citizens and communities up and down the coast, and by the thousands of residents of inland San Diego County who use and enjoy the shoreline.

Figure 1

CRITICAL SHORELINE EROSION PROBLEM AREAS



The unprecedented amount of knowledge gained from the Coast of California Study allows us, for the first time, to be able to measure the extent of the region's current and future shoreline erosion and to identify potential solutions to slow or reverse erosion problems. The menu of solutions includes: beach building by placing large amounts of sand on eroded beaches; structures to help hold sand in place, such as groin fields; structures to protect property, such as seawalls and sand berms; and policies and regulations regarding the use of the shoreline and its development, such as bluff top building setbacks. The Shoreline Preservation Strategy consists of a coordinated list of solutions for each of the region's shoreline problem areas, and an action plan for carrying out and paying for the solutions.

Who's Involved?

The Strategy is being put together by the SANDAG Shoreline Erosion Committee, which is made up primarily of mayors and councilmembers from the region's coastal cities. They will rely on the advice and opinions of the technical advisory members of the Committee representing state and federal agencies involved in managing the shoreline, and of the many individuals and interest groups who will review and comment on preliminary strategy options - the entire region will be involved in developing and deciding on the Strategy. In order for the Strategy to be effective, everyone in the region will also have to work together to carry it out.

Themes

The most important idea guiding the Strategy is coordination. Coastal science tells us that events in one part of the shoreline will also affect beaches and seacliffs up coast and down coast, because sand moves laterally along the shoreline. We now have the knowledge to coordinate shoreline management actions occurring at different places and times, and to make sure positive impacts on beaches and seacliffs are reinforced, and negative ones minimized.

Another very important point about the Shoreline Preservation Strategy is that our role in preserving and enhancing the region's shoreline will have to be an ongoing, long-range, undertaking. This stewardship of the shoreline will involve a number of coordinated actions taking place on a continuing schedule over the years. The Shoreline Preservation Strategy is the action plan for this stewardship. The Strategy looks ahead 20 and 50 years in the future, to ensure that it can respond to the needs of shoreline structures and public improvements being implemented today.

Finally, the Strategy proposes an action plan that requires a major monetary commitment from people in our region, as well as from the state and federal governments.

Objectives

The Shoreline Preservation Strategy has four main objectives:

1. Manage the region's shoreline to provide environmental quality, recreation and property protection.
2. Develop and carry out a cost-effective shoreline management strategy that will have a positive impact on the region's economy.
3. Develop a program to pay for the shoreline management strategy which equitably allocates costs among local, state and federal sources, and among beach users and property owners.
4. Obtain commitments to implement and finance the Shoreline Management Strategy.

Recommendations

The Shoreline Preservation Strategy recommendations are based on the scientific information from the Coast of California Study and on Engineering and Economic analysis

of the potential impact of shoreline erosion on coastal property, and beach recreation demand and revenues. The recommendations include proposals for each problem area, regionwide recommendations which apply to all of the problem areas, and implementation, financing and institutional recommendations for carrying out the Strategy.

Beach Building –

A beach building and maintenance program was found to be the most cost-effective shoreline management tactic, and is recommended for each of the three problem areas. These problem areas, from south to north, are the shoreline segments for:

- 1) Silver Strand State Beach in the southern part of Coronado, all of Imperial Beach, and extending about 2½ miles south into Mexico;
- 2) Ocean Beach in San Diego; and
- 3) The entire shoreline from Oceanside Harbor South to Torrey Pines and Scripps beaches in San Diego.

These beach building and maintenance programs emphasize the nourishment of narrow beaches with sand to make them wide enough to provide needed property protection and recreational capacity. Potential major sources of sand to support these beach building activities have been identified at offshore sand bars and water storage reservoirs. There are a number of smaller sources of sand for beach building such as harbor dredging projects. The development of the beach building programs for each problem area will require a detailed engineering, economic and environmental design study. In addition to nourishment, the study design for each area should consider a full range of shoreline management methods that can support beach widening and make it more cost effective.

The initial beach building program would require the placing of about 30 million cubic yards of sand on beaches in the three problem areas. The capital cost is estimated in the

range of \$150 million. The annualized long-term cost of the beach building and maintenance program for the region is estimated in the range of \$5.5 million per year. The annual value to the region's economy of this expenditure in 2010 is estimated to be \$8 million in property protection and \$45 million in recreation revenues and benefits. By 2040, the annual values are estimated to be \$35 million and \$190 million, respectively.

Financing –

Traditional State and Federal funding sources should continue to be pursued, but can be counted on to cover only a portion of the total financing needed to carry out the Strategy. Therefore, a financing program is recommended that emphasizes local funding sources, coordinated on a region-wide basis to ensure equity and build support. The local funding program should include: shoreline property owners who will receive major benefits, both directly due to protection from storm damage and indirectly in terms of property value; visitors to the region who use and enjoy the benefits of the shoreline; and all of the region's residents and businesses who benefit substantially through their use of shoreline beaches and parks, their property values and economic activity.

Institutional –

The cooperative and interjurisdictional nature of the recommended beach building and maintenance program, and the significant amount of funds to be raised and expanded to carry them out, will require additional cooperative intergovernmental arrangements among the region's local jurisdictions. The purpose of these additional arrangements should be to formalize joint decision making about the implementation of the Shoreline Preservation Strategy for each problem area, and to provide a mechanism for financing. The format of additional arrangements in each problem area could range from the designation of a lead agency and the signing of a Memorandum of Agreement, to the formation of a joint powers agency or shoreline authority to carry out implementation. There may also need to be additional arrangements set up to coordinate financing and implementation on a regionwide basis. The most appropriate types of intergovernmental arrangements will

depend to some extent on the financing mechanisms chosen. The institutional arrangements for implementation of the Strategy should therefore be developed concurrently with the financing program.

The Shoreline Erosion Committee and SANDAG should continue to coordinate shoreline preservation activities for the region, including the development of the beach building and maintenance programs, the regionwide financing program, and the cooperative arrangements needed to implement the Strategy.

Implementation —

A three-phase implementation schedule is recommended:

Phase I, between now and July 1992, will include: securing approval of the Strategy; completion of several early action program items, for example, guidelines to help local jurisdictions make decisions about shoreline land use and storm protection structures; obtaining the approximately \$2 million needed to complete the beach building and maintenance design studies in Phase II; and, development of the financing program and cooperative intergovernmental arrangements necessary to carry out the Strategy.

Phase II, from July 1992 through December 1992, will include completion of the design studies and agreement and implementation of the financing program and cooperative intergovernmental arrangements.

Phase III, starting January 1993, will initiate the beach building and maintenance programs.

II INTRODUCTION

II INTRODUCTION

The Region's Shoreline - A Valuable Resource

The shoreline is a valuable asset to the environment and economy of the San Diego region and the State. It is also considered a resource of national significance. The beaches and seacliffs help define this area's quality of life; when we think of the region's positive image, we most often think of the climate and the shoreline.

The Problem

Long time residents are aware that many of the area's beaches and seacliffs have been steadily eroding for the past decade. The Coast of California Study, a six-year, \$6 million scientific evaluation of the San Diego region shoreline conducted by the U.S. Army Corps of Engineers, documented the observations of local people about shoreline erosion and has projected trends of increasing beach loss and property damage in the future.

How We Got Where We Are Today

Over the past half century, man's actions have been the major influence affecting our shoreline. Through urban development and water reservoir and dam building, we have cut off the natural source of sand for our beaches - sediment carried from inland areas by rivers and streams. This sand is also the primary buffer protecting seacliffs and coastal development from erosion and storm damage. At the same time, our activities have made up, and some places even exceeded, the natural sand sources no longer reaching the shoreline, through the building of "man made" beaches. Most of the sand for this purpose

has come from massive and expensive harbor dredging projects in San Diego Bay and at Oceanside Harbor. While sources of sand as large as these dredging projects will probably never be available in the future, we have no choice but to continue our stewardship of the shoreline, or see the gradual thinning and disappearance of our beaches and increasing destruction of coastal property and development.

How the Shoreline Preservation Strategy Will Help

The Shoreline Preservation Strategy is the San Diego region's response to the concerns about erosion voiced by citizen and communities up and down the coast, and by the thousands of residents of inland San Diego County who use and enjoy the shoreline.

The unprecedented amount of knowledge gained from the Coast of California Study allows us, for the first time, to be able to measure the extent of the region's current and future shoreline erosion and to identify potential solutions to slow or reverse erosion problems.* The menu of solutions includes: beach building by placing large amounts of sand on eroded beaches; structures to help hold sand in place, such as groin fields; structures to protect property, such as seawalls and sand berms; and policies and regulations regarding the use of the shoreline and its development, such as bluff top building setbacks. The Shoreline Preservation Strategy consists of a coordinated list of solutions for each of the region's shoreline problem areas, and an action plan for carrying out and paying for the solutions.

Who's Involved in the Shoreline Strategy?

The Strategy is being put together by the SANDAG Shoreline Erosion Committee, which is made up primarily of mayors and councilmembers from the region's coastal cities.

*The rocky headlands and seacliffs, and the small "pocket" beaches of La Jolla and Point Loma were not covered in the Coast of California study. The information and recommendations of the Shoreline Preservation Strategy do not pertain directly to these areas.

They will rely on the advice and opinions of the technical advisory members of the Committee representing state and federal agencies involved in managing the shoreline, and of the many individuals and interest groups who will review and comment on preliminary strategy options - the entire region will be involved in developing and deciding on the Strategy. In order for the Strategy to be effective, everyone in the region will also have to work together to carry it out.

Important Themes

The most important idea guiding the preparation of the Strategy is coordination. Coastal science tells us that events in one part of the shoreline will also affect beaches and seacliffs up coast and down coast, because sand moves laterally along the shoreline. We now have the knowledge to coordinate shoreline management actions occurring at different places and times to make sure positive impacts on beaches and seacliffs are reinforced, and negative ones minimized.

Another very important point about the Shoreline Preservation Strategy is that our role in preserving and enhancing the region's shoreline will have to be an ongoing, long-range, undertaking. This stewardship of the shoreline will involve a number of coordinated actions taking place on a continuing schedule over the years. The Shoreline Preservation Strategy is the action plan for this stewardship. The Strategy looks ahead 20 and 50 years in the future, to ensure that it can respond to the needs of shoreline structures and public improvements being implemented today.

Finally, the Strategy proposes an action plan that requires a major monetary commitment from people in our region, as well as from the state and federal governments. The toughest decisions about the Shoreline Preservation Strategy will be:

- Are we willing to pay the cost of preserving our beaches and protecting coastal property and development?

- If so, how can the costs be fairly distributed among those who live along the coast, those who use the beach (both residents and tourists), local governments, and the state and federal governments?

Shoreline Management Methods

Figure 2 shows the shoreline management methods considered in developing the San Diego Region's Shoreline Preservation Strategy. The methods are grouped into six categories. They all have the potential to contribute to meeting the two basic goals of the strategy:

1. Preserve and enhance the region's beaches
2. Protect property and development from storm wave damage and coastal flooding.

Detailed descriptions of all of these shoreline management methods and the related data from the Coast of California Study that can be used to evaluate their application to particular reaches (lengths) of shoreline in the region will be found in Chapters 3 and 5 of the Coast of California Planner's Handbook. Final drafts of these chapters are now being prepared by the U.S. Army Corps of Engineers.

The first four groups of shoreline management methods on the chart - a and b) beach building and maintenance, c) reducing sand losses, and d) redistributing sand along the coast - are primarily regional scale actions aimed directly at increasing the amount of sand on the region's beaches. They will usually affect all or a significant portion of one of the region's three littoral cells. (A littoral cell is a self contained shoreline unit in which actions taken in one reach of the cell will eventually affect the other reaches.) These four groups of management methods have been used by SANDAG and its coastal engineering consultant to design an action plan to address the shoreline problem areas in each littoral cell.

POTENTIAL SHORELINE MANAGEMENT METHODS

REGIONAL SCALE METHODS

A. Beach Building and Maintenance, Using Sand From:

- harbor and lagoon dredging
- offshore sand deposits
- seacliffs and coastal terraces

B. Beach Building and Maintenance, Using Upland Sources of Sand From:

- reservoirs
- rivers and streams
- grading of development construction sites
- other upland sources

C. Reduce Sand Losses to:

- submarine canyons
- offshore sand deposits

D. Redistribute Sand Along the Shoreline by:

- bypassing (moving sand down coast past barriers such as harbor jetties)
- backpassing (moving sand up coast, to recirculate it along its natural direction of flow down the coast)
- groins (to hold sand in a particular reach, or length, of the shoreline)
- offshore breakwaters (to minimize the ability of waves to move sand from a particular reach; includes development of kelp beds as well as hard structures)

LOCAL SCALE METHODS

E. Regulate Shoreline Land Use and Development by:

- minimizing construction on beaches and in front of seacliffs
- requiring setbacks from seacliffs, beaches and low lying coastal areas
- regulation of sand mining

F. Protect Property from Storm Waves, Flooding and Seacliff Erosion by:

- artificial dunes
- seawalls and revetments

The last two groups of shoreline management methods on the chart - e) regulation of shoreline land use and development, and f) protection of property from storm waves and flooding - are primarily local scale methods of dealing with shoreline problems. While these methods can do little to add sand to the shoreline, they can make the sand management techniques in the first three groups on the chart more effective.

The objective of the Shoreline Preservation Strategy for these two groups of management methods is to have a regionally consistent and scientifically sound set of policies for applying them, and an effective regulatory mechanism for evaluating and implementing them.

Reaching Agreement on the Shoreline Strategy

Step 1: SANDAG and the Shoreline Erosion Committee have put together information needed to make decisions about the Shoreline Preservation Strategy in this draft, including:

- Shoreline problem areas, current and future
- Policies, objectives and recommended actions to preserve beaches, seacliffs and property in each problem area, and their costs
- The costs of not taking action
- A discussion of the options for paying for the Strategy and new cooperative relationships (if needed) to carry it out.

Step 2: With concurrence by the SANDAG Board of Directors, the draft Strategy will be presented to the region -- interested citizens, community and interest groups, local governments, and to state and federal government agencies

involved in shoreline management. The purpose will be to collect the opinions and recommendations of everyone on questions such as:

- Are the shoreline management actions described effective and do-able?
- What level of shoreline preservation and enhancement is necessary, and what level are people willing to pay for?
- Is there a way to collect and spend the money needed to carry out the Strategy that is considered fair and can be supported?

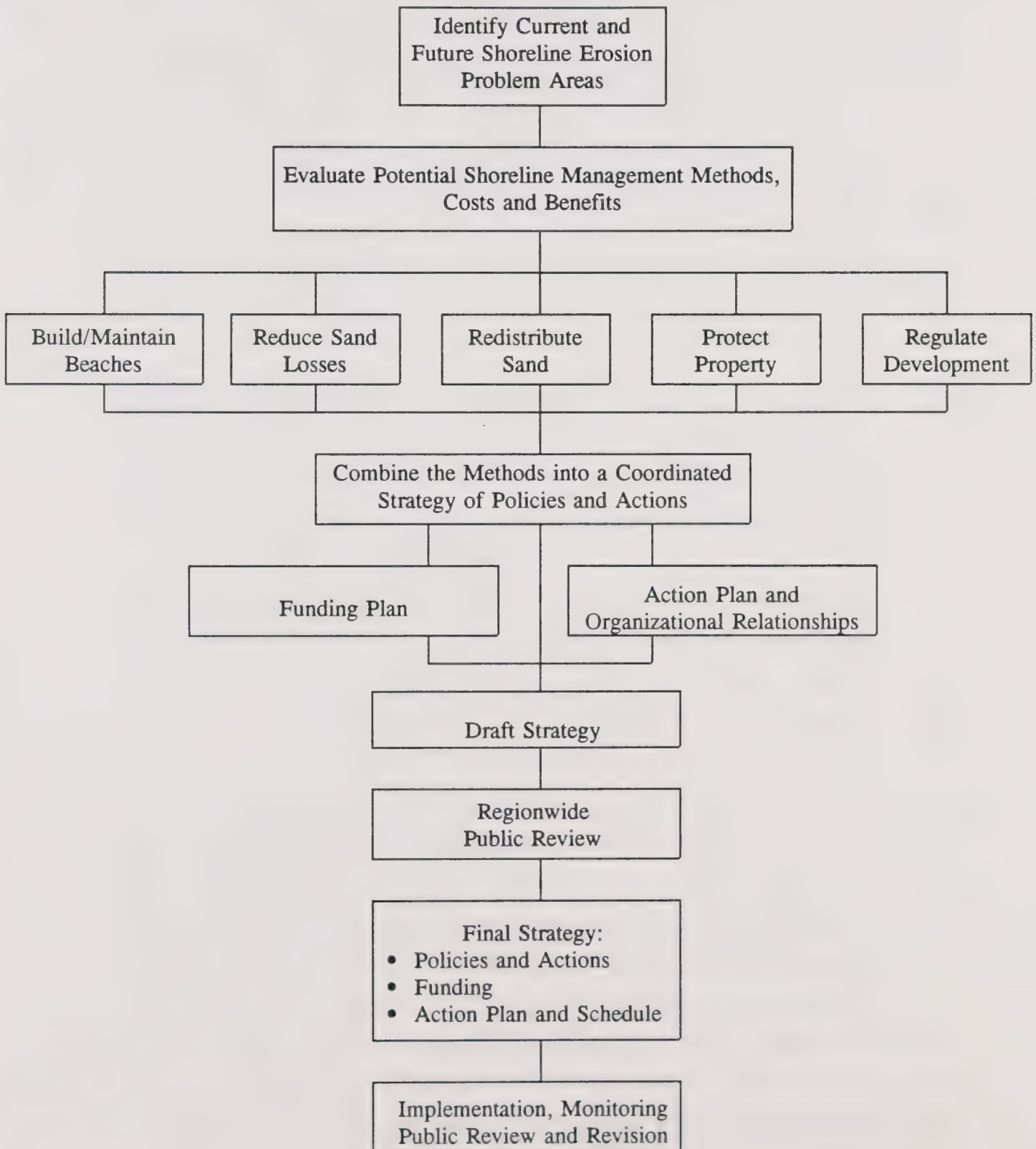
Step 3: The Shoreline Erosion Committee will take the lead in putting together the results of the region's discussion of shoreline problems and solutions. Their challenge will be to develop a Shoreline Preservation Strategy which represents a consensus about what can and should be done. The Strategy, including a very specific listing of actions and responsibilities, and an implementation timetable, will be presented to the SANDAG Board and the region's local governments for approval. Concurrence by involved state and federal agencies, such as the Coastal Commission and the U.S. Navy, will also be sought.

Step 4: It is expected that final agreement on the Strategy and its approval could be completed by early 1992. The Shoreline Erosion Committee will then coordinate, monitor and assist implementation of the action program. The Committee will ensure widespread public communication of progress and problems encountered, and will continue to provide a way for everyone who is interested to provide feedback and propose adjustments as the Strategy is carried out.

Figure 3 shows the various parts of the Shoreline Preservation Strategy, and illustrates how they will be combined.

Figure 3

SAN DIEGO REGIONAL
SHORELINE PRESERVATION STRATEGY



III SHORELINE PROBLEMS AND NEEDS

III

SHORELINE PROBLEMS AND NEEDS

Present and Future Beach Widths - The Effects of Erosion


One of the most important tasks in developing the Shoreline Preservation Strategy involves estimating the present and future widths of the region's beaches and comparing them to the beach widths estimated to be needed for property protection and recreation. These estimates were made possible by the extensive data on the region's shoreline collected by the Coast of California Study. Figures 4, 5, and 6 show the estimated annual mean beach widths for the region's three littoral cells for the years 1990, 2010 and 2040. The estimated beach widths needed for property protection and recreation are also shown on those maps. Each of the three littoral cells shown in Figures 4, 5, and 6 has been divided into segments, or reaches, designated by dashed horizontal lines. The segments roughly correspond to city boundaries, and state and federal ownership in some cases.

These three littoral cells are: the Silver Strand cell which extends from south of the international border to the Zuniga jetty at San Diego Bay and includes the Shorelines of the Cities of Imperial Beach and Coronado; the Mission Bay Cell which extends from Point Loma to Point La Jolla in the City of San Diego, and; the southern half of the Oceanside Cell including shorelines of the Cities of San Diego, Del Mar, Solana Beach, Encinitas, Carlsbad and Oceanside. The northern half of the Oceanside cell extends north from Oceanside Harbor to Dana Point in Orange County. Data for this area is included in the appendix.

The significant decrease in annual mean beach width estimated for future years in the Oceanside and Silver Strand littoral cells illustrates the effects of shoreline erosion on the region. The figures show that the most critical areas are located at Imperial Beach and South Oceanside and that extensive erosion will also take place in the rest of the Oceanside Cell, in the southern half of the Silver Strand Cell and at Ocean Beach in the Mission Bay Cell.

ESTIMATED ANNUAL MEAN BEACH WIDTHS

1990 

2010 

2040 

Estimated annual mean beach width
needed to protect property
and meet recreation demand

**FIGURE 4
SILVER STRAND
LITTORAL CELL**



NAVY N.I.

CORONADO

NAVY
AMPHIB.

Silver Strand
State Beach

NAVY
COMM.

IMPERIAL
BEACH

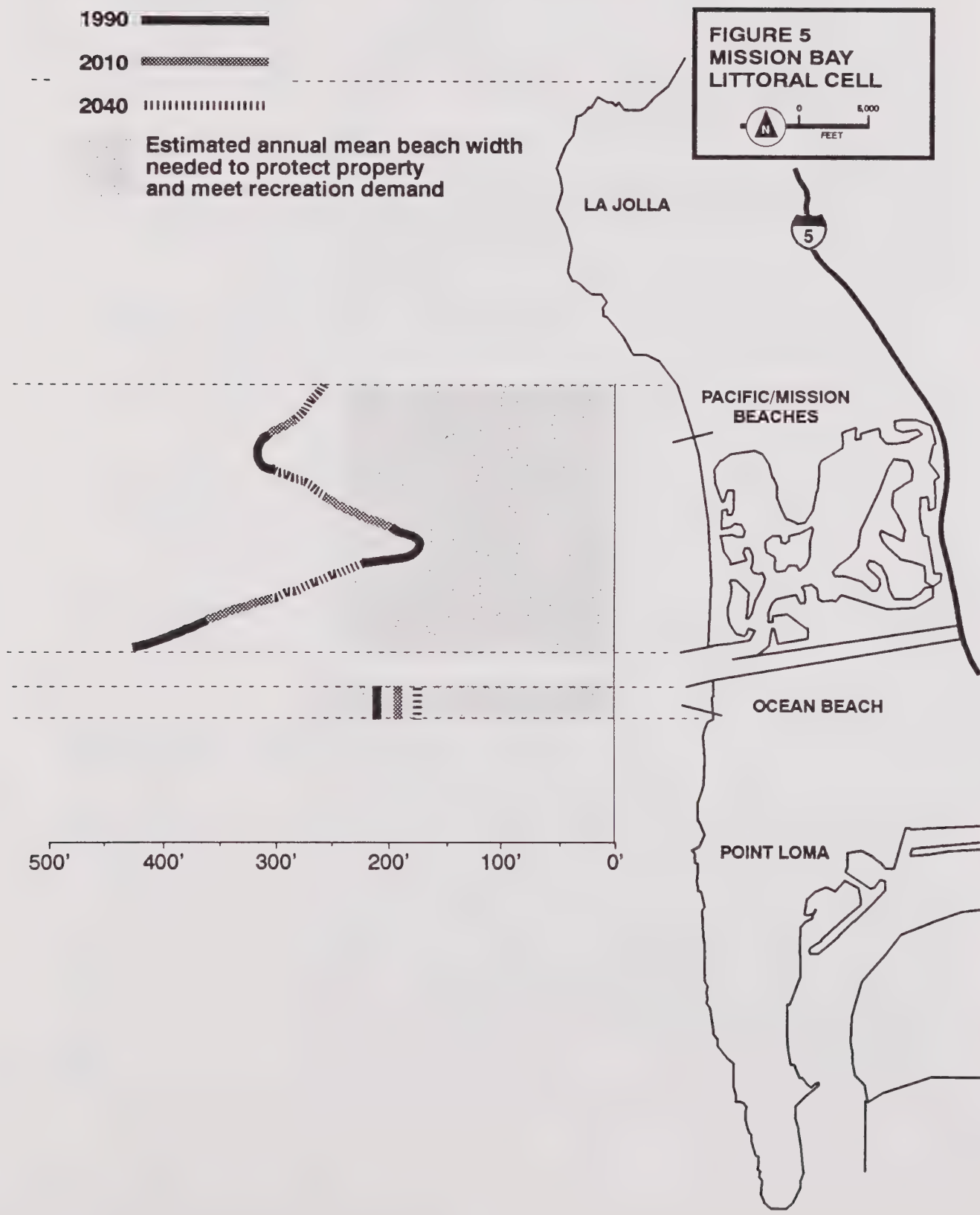
Border Field
State Park

Mexico

City Boundary


700' 600' 500' 400' 300' 200' 100' 0'

ESTIMATED ANNUAL MEAN BEACH WIDTHS



ESTIMATED ANNUAL MEAN BEACH WIDTHS

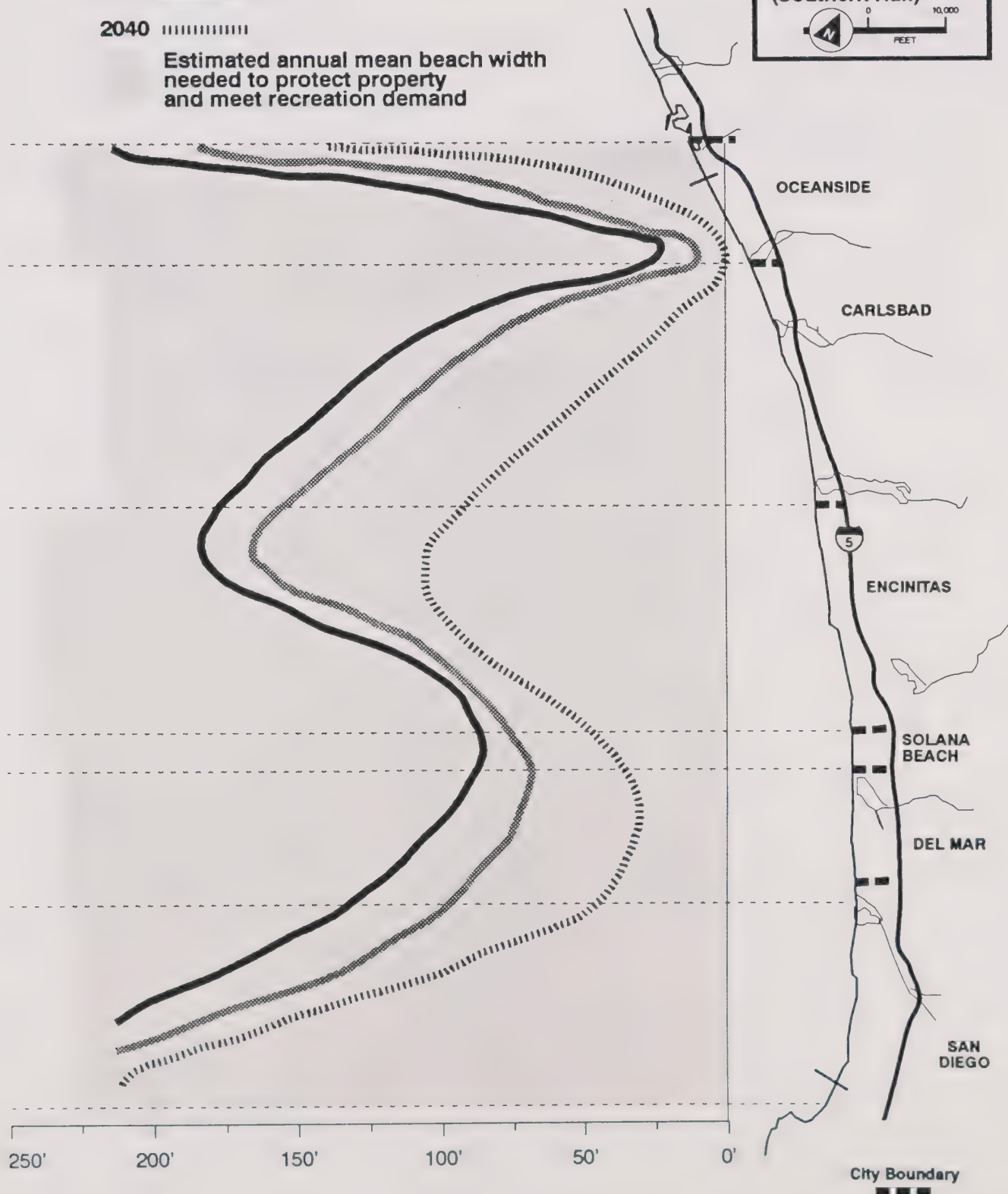
1990 —————

2010 —————

2040 —————

Estimated annual mean beach width
needed to protect property
and meet recreation demand

FIGURE 6
OCEANSIDE
LITTORAL CELL
(Southern Half)



There are several points to take into consideration regarding the estimated beach widths:

- beach width is defined as the distance between mean sea level and a point delineating the back of the beach, such as a road, structure or the base of a seacliff;
- the beach widths shown are annual averages that take into account significant seasonal fluctuations which usually result in narrower beaches during the winter and wider beaches in the summer;
- future beach width estimates do not assume any future beach replenishment projects but do include the effects of ongoing sand bypassing projects at Oceanside Harbor and Agua Hedionda Lagoon;
- the widths in the Oceanside Cell assume that currently unprotected seacliffs will continue to retreat at their natural rate, adding sand to the beaches;
- the estimates account for increases in the rate of sea level rise and caused by the "greenhouse effect."

Shoreline Erosion Problems and Needs

Figure 7 compares in chart form the data presented in Figures 4, 5 and 6: the estimated annual mean beach widths, averaged for each reach, to the estimated beach width needed for property protection and to accommodate recreation demand. The assumptions, data and methods used in deriving these estimates are described in the appendix, along with maps showing the comparison of needs and beach widths. Reaches where erosion is expected to cause losses of shorefront property and of beach recreation capacity are highlighted.

Figure 7

SAN DIEGO REGION
ESTIMATED ANNUAL MEAN BEACH WIDTHS
COMPARED TO NEEDS
(FEET)

<u>Shoreline Segment (Reach)</u>	<u>Year</u>	<u>Estimated Actual</u>	<u>Estimated Need^a For Design Property Protection</u>	<u>Estimated Need to^b Accommodate 100 % of Recreation Demand</u>
<u>Silver Strand Cell</u>				
Border Field	1990	150	250	26
	2010	100	250	26
	2040	40	250	26
Imperial Beach	1990	150	238	119
	2010	110	238	149
	2040	60	238	196
Navy-Communications	1990	210	236	-
	2010	190	236	-
	2040	90	236	-
Silver Strand	1990	220	210	43
	2010	210	210	55
	2040	175	210	73
Navy-Amphibious	1990	270	209	-
	2010	265	209	-
	2040	260	209	-
Coronado	1990	560	232	59
	2010	570	232	80
	2040	560	232	110
Navy-North Island	1990	640	216	-
	2010	680	216	-
	2040	690	216	-

^aThe design width is estimated to protect shorefront property from storms up to and including the estimated 100 year storm.

^bAssuming 100 square feet of beach per person at peak use.

Figure 7

SAN DIEGO REGION
ESTIMATED ANNUAL MEAN BEACH WIDTHS
COMPARED TO NEEDS
(FEET)
(Continued)

<u>Mission Bay Cell</u>				
Ocean Beach	1990	215	260	753
	2010	200	260	914
	2040	185	260	1159
Mission & Pacific Beaches	1990	270	232	415
	2010	270	232	503
	2040	270	232	638
<u>Oceanside Cell</u>				
San Diego	1990	155	228	130
	2010	130	228	179
	2040	100	228	256
Del Mar	1990	105	232	94
	2010	75	232	130
	2040	30	232	189
Solana Beach	1990	80	232	167
	2010	70	232	228
	2040	35	232	325
Encinitas	1990	125	240	97
	2010	115	240	136
	2040	90	240	195
Carlsbad	1990	105	216	107
	2010	90	216	145
	2040	40	216	207
Oceanside	1990	55	232	79
	2010	40	232	111
	2040	20	232	161
Camp Pendleton	1990	270	240	-
	2010	290	240	-
	2040	295	240	-
San Onofre	1990	205	222	29
	2010	230	222	42
	2040	250	222	63
Orange County	1990	180	224	57
	2010	140	224	80
	2040	100	224	120

IV
EVALUATION OF SHORELINE
MANAGEMENT ALTERNATIVES

IV EVALUATION OF SHORELINE MANAGEMENT ALTERNATIVES

There are three basic shoreline management alternatives available:

- Do Nothing
- Armor the coast to protect property, using seawalls and revetments
- Beachfilling to protect property and provide recreation

There are costs and benefits associated with all three alternatives. The following evaluation provides planning estimates of these costs and benefits, based on the information in the "Estimated Volumes, Costs and Benefits of Beachfilling" table, and the "Data, Assumptions and Evaluation Methods" information contained in the appendix.

Do Nothing Alternative

This alternative would "let nature take its course" and result in significant costs to the region in lost property and recreational benefits due to shoreline retreat. No benefits are available from this strategy.

Do Nothing Alternative
Estimated Annual Costs
(Millions of 1990 \$)

<u>Littoral Cell</u>	<u>Year</u>	<u>Lost Recreation Benefits</u>	<u>Lost Property Value</u>	<u>Net Total</u>
Silver Strand	1990	-0	-.2	-.2
	2010	-0	-1.3	-1.3
	2040	-0	-8.2	-8.2
Mission Bay	1990	-13.6	-.01	-13.6
	2010	-24.4	-.04	-24.4
	2040	-35.0	-.1	-35.5
Oceanside (San Diego County Beaches)	1990	-0	-2.3	-2.3
	2010	-20.6	-6.5	-27.1
	2040	-156.8	-26.6	-183.4
San Diego Region	1990	-13.6	-2.5	-16.1
Totals	2010	-45.0	-7.8	-52.8
	2040	-191.8	-34.9	-226.7

Armoring the Coast Alternative

Armoring the coast with seawalls and revetments would provide benefits by protecting property from storm damage. Shoreline erosion would not be affected, so that recreational benefits would continue to be lost in an amount equal to that for the do nothing alternative. The annualized cost of protective structures is assumed to be \$40 per linear foot, and they are estimated to have a 20-25 year life. It is also estimated that about 20% of the Oceanside cell already has shorefront protective structures. Only shoreline reaches with beaches estimated to be narrower than the design property protection width are assumed to need protective devices.

Armoring the Coast Alternative
Estimated Annual Costs and Benefits
(Millions of 1990 \$)

<u>Littoral Cell</u>	<u>Year</u>	<u>Cost of Protective Structures</u>	<u>Lost Recreation Benefits</u>	<u>Property Protection</u>	<u>Net Total</u>
Silver Strand	1990	-1.1	0	+.2	-.9
	2010	-1.1	0	+1.3	+.2
	2040	-1.5	0	+8.2	+6.7
Mission Bay	1990	-.2	-13.6	+.01	-13.8
	2010	-.2	-24.4	+.04	-24.6
	2040	-.2	-35.0	+.1	-35.1
Oceanside (San Diego County Beaches)	1990	-4.2	-0	+2.3	-1.9
	2010	-4.8	-20.6	+6.5	-18.9
	2040	-5.3	-156.8	+26.6	-135.5
San Diego Region Totals	1990	-5.5	-13.6	+2.5	-16.6
	2010	-6.1	-45.0	+7.8	-43.3
	2040	-7.0	-191.8	+34.9	-163.9

Beachfilling Alternative

Beachfilling to meet estimated design protection and accommodate 100% of estimated recreation demand would provide full property protection and recreation benefits. There would be significant costs of providing the beachfill projects. These costs and benefits are detailed in the "Estimated Volumes, Costs and Benefits of Beachfilling" table, and summarized here.

Beachfilling Alternative
Estimated Annual Costs and Benefits
(Millions of 1990 \$)

<u>Littoral Cell</u>	<u>Year</u>	<u>Cost of BeachFill</u>	<u>Recreation Benefit</u>	<u>Property Protection</u>	<u>Net Total</u>
Silver Strand	1990	-.8	+0	+.2	-.6
	2010	-.8	+0	+1.3	+.5
	2040	-.8	+0	+8.2	+7.4
Mission Bay	1990	-.6	+13.6	+.01	+13
	2010	-.6	+24.4	+.04	+23.8
	2040	-.6	+35.0	+.1	+34.5
Oceanside (San Diego County Beaches)	1990	-4.2	+0	+2.3	-1.9
	2010	-4.2	+20.6	+6.5	+22.9
	2040	-4.2	+156.8	+26.6	+179.2
San Diego Region Totals	1990	-5.6	+13.6	+2.5	+10.5
	2010	-5.6	+45.0	+7.8	+47.2
	2040	-5.6	+191.8	+34.9	+221.1

Conclusion

Beachfilling is by far the most cost effective shoreline management alternative for the San Diego region. The do nothing alternative is very expensive for the region, ranging up to an estimated annual cost of over \$200 million in the year 2040. Armoring the coast also costs the region a substantial amount of money. In addition the evaluation indicates that beachfilling is a more cost-effective way to protect property than armoring. For example, the average annual cost of armoring the coast to protect property is \$1.1 million dollars for the Silver Strand littoral cell. The average annual cost of a comparable amount of property protection derived from beachfilling is \$.8 million. Nonetheless, there may be specific properties where armoring will be necessary for property protection because the specific physical situation makes it more cost effective, or because the availability of beachfill is uncertain, or because a more technically certain protective strategy is desired.

In some instances a combination of beachfill and protective structures might be considered to provide recreational benefits and property protection.

Silver Strand Cell

- property protection is the most important factor in determining the need for shoreline management in this cell.
- the problem areas in this cell are primarily in the southern half of the cell.
- beachfilling is the most cost effective shoreline management method overall.

Mission Bay Cell

- providing recreational capacity is the most important factor in determining the need for shoreline management in this cell.
- the analysis indicates that the beach recreation use data and assumptions need to be reviewed as they apply to this cell. It appears that these beaches have reached, and exceeded, their estimated peak capacity.
- beach access, as it is affected by traffic and parking, will limit maximum beach width needed.
- the physical capacity of the shoreline to hold beaches of the widths estimated to be needed is questionable without retaining structures.
- while it is clear that these beaches need additional width, and that beachfilling is the most cost effective management method, further review of beach access and beach use is necessary before effective beach widths are determined in this cell.

Oceanside Cell

- property protection is the most important factor in determining the need for shoreline management in this cell.
- problem areas occur along the entire southern half of this cell, from Oceanside Harbor to La Jolla Shores beach in San Diego.

- beachfilling is the most cost effective management method overall.
- a beachfilling program to meet property protection needs in this cell will also result in significant recreation benefits.

Entire Regional Shoreline

- it appears that beach access, as it is affected by traffic and parking, will be a significant issue in the future, and probably is today for many beaches.
- a beachfilling program can be justified for either property protection or recreational purposes, and the benefit to cost ratio for beachfilling indicates that it is an economically attractive activity.
- the high benefit to cost ratios illustrate that even if the assumptions and data used in the evaluation are extremely optimistic from the standpoint of beachfilling (even by a factor of two or more) beachfilling is still a beneficial economic investment. It should be noted that the assumptions and data were developed to be conservative in terms of the economic benefit to be derived from shoreline management actions.

V
POLICIES AND OBJECTIVES

V POLICIES AND OBJECTIVES

Objectives

1. Manage the region's shoreline to provide environmental quality, recreation and property protection.
2. Develop and carry out a cost-effective shoreline management strategy that will have a positive impact on the region's economy.
3. Develop a program to pay for the shoreline management strategy which equitably allocates costs among local, state and federal sources, and among beach users, businesses and property owners.
4. Obtain commitments to implement and finance the Shoreline Management Strategy.

Policies

- A. The Strategy should provide a cooperative, coordinated, and long range preservation program for the region's three littoral cells.
- B. The Strategy should consider the full range of shoreline management tactics, with emphasis on beachfilling to preserve and enhance the environmental quality, recreational capacity and property protection benefits of the region's shoreline.

- C. The Strategy should provide planning estimates of the amount, placement, timing, cost and sources of beachfill.
- D. Policies and actions to promote the availability of offshore, coastal and upland sources of sand for beachfilling and natural beach replenishment should be developed.
- E. The Strategy should provide guidelines for coordinated and consistent approaches to local level management methods, including regulation of shoreline land use and development, and property protection measures such as artificial dunes, seawalls and revetments.
- F. Structural and mechanical management tactics to reduce sand losses and redistribute sand along the shoreline should be evaluated as complements to the regional beachfilling program and implemented where they have a positive impact on cost-effectiveness.
- G. The Strategy should evaluate local, state and federal policies and regulations and recommend changes to support the other policies and objectives.
- H. The Strategy should be based on the best available scientific data and analysis and on sound engineering principles.

VI RECOMMENDATIONS

VI RECOMMENDATIONS

The Shoreline Preservation Strategy recommendations are based on the information, evaluation and policies and objectives presented in the previous sections of the Strategy. The recommendations include proposals for each littoral cell, regionwide recommendations which apply to all of the littoral cells, and implementation, financing and institutional recommendations for carrying out the Strategy.

A beach building and maintenance program is recommended for each of the three littoral cells. These programs emphasize the nourishment of narrow beaches with sand to make them wide enough to provide needed property protection and recreational capacity. In addition to nourishment, the design of each beach building and maintenance program should consider a full range of shoreline management methods that can support beach widening and make it more cost effective.

Silver Strand Littoral Cell

1. Design and carry out a cost-effective beach building and maintenance program for the southern half of the cell, from Silver Strand State Beach south to the International Border, focusing on the Imperial Beach Shoreline.
 - a. The initial volume of sand needed for beach building (increasing the width of the beach) in this area could be as much as 3 million cubic yards and cost in the range of \$15 million. Maintaining the increased beach width could require as much as 90,000 cubic yards of sand per year at an annual cost in the range of \$500,000. It is estimated that the economic benefits from property

protection and recreation will exceed the costs of the beach building and maintenance program within 10 years. Over the long term (20 to 50 years), economic benefits will substantially exceed costs.

- b. The major sources of sand for the beach building and maintenance program include offshore borrow sites near Imperial Beach (estimated 32 million cubic yards of sand) and near Silver Strand State Beach (estimated 348 million cubic yards of sand). Other potential sand sources include onshore borrow sites in the Sweetwater and Tijuana Rivers and San Diego Bay dredging. Figure 8 identifies the potential sand sources for this cell.
- c. The design of the beach building and maintenance program should include consideration of: the two part role of the Tijuana River delta in protecting the Imperial Beach shoreline from erosion (as a source of sand that replenishes the beach at Imperial Beach and the rest of the cell, and as a buffer from wave energy that reduces alongshore transport of sand away from Imperial Beach); the relationship of beach width to shoreline retreat and amount of beachfill needed; the relationship of alongshore to offshore sand transport rates and amount of beachfill needed; variations in annual mean beach width, and in seasonal changes in beach width within the littoral cell; the need for groins or offshore breakwaters in particular areas to regulate the movement of sand up and down coast; the level of property protection, recreation demand accommodation and beach width desired; the role of development regulation and shoreline protective devices in reducing the need for beach building and maintenance in particular areas; safety, water use and liability issues related to shoreline management structures; the matching of sand at borrow sites with the needs of nearby beaches; locations for beachfill placement; effects on surfing conditions; environmental impacts on water quality, plant and animal species and their habitats; and the start date for the program. Finally, the program design should be flexible to respond to changing shoreline conditions and new information.

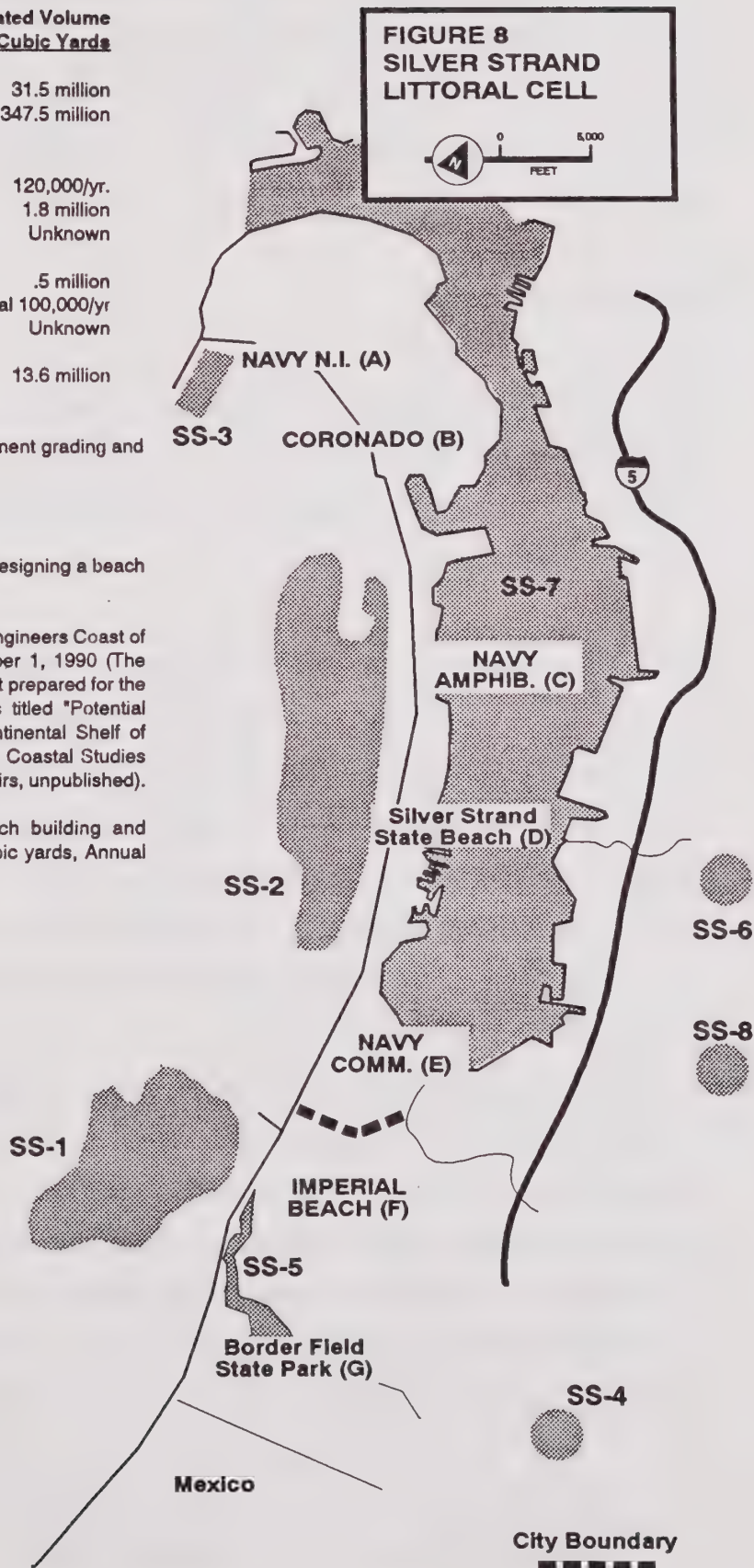
POTENTIAL SAND SOURCES FOR BEACH BUILDING AND MAINTENANCE

Source	Estimated Volume In Cubic Yards
SS-1 (Offshore Imperial Beach)	31.5 million
SS-2 (Offshore Silver Strand)	347.5 million
SS-3 (Collection of sand moving offshore at Zuniga Jetty)	120,000/yr.
SS-4 (Tijuana River)	1.8 million
SS-5 (Tijuana Estuary Enhancement)	Unknown
SS-6 (Sweetwater River, east of mapped area)	.5 million
SS-7 a. (San Diego Harbor dredging)	0-several 100,000/yr
b. (San Diego Bay enhancement)	Unknown
SS-8 (In the following water storage reservoirs: Barrett, Loveland, Morena and Upper Otay)	13.6 million

Not shown on this map: water storage reservoirs, development grading and other upland sources.

Notes:

- Volumes are rough estimates which should be refined in designing a beach building and maintenance program.
- Source of estimated volumes is the U.S. Army Corps of Engineers Coast of California Study, Draft State of the Coast Report, October 1, 1990 (The estimates for offshore volumes are based on a 1983 report prepared for the California State Department of Boating and Waterways titled "Potential Offshore Sand and Gravel Resources of the Inner Continental Shelf of Southern California") and the Scripps Institute Center for Coastal Studies (1991 estimates of volumes in listed water storage reservoirs, unpublished).
- Volumes of sand needed for the recommended beach building and maintenance program in this cell: Initial Fill: 3 million cubic yards, Annual Maintenance: 90,000 cubic yards.



2. Determine the feasibility and cost effectiveness of capturing sand at the northern end of the cell near Zuniga jetty, and backpassing it to the southern portion of the cell where beaches are narrower. Design and carry out a backpassing project if it is a feasible and cost-effective method of supplementing the beach building and maintenance program.

Mission Bay Littoral Cell

1. Design and carry out a cost-effective beach building and maintenance program for the Ocean Beach portion of the cell. Initially, this program should be designed to widen the beach to meet property protection needs (increases in recreational capacity would also occur).
 - a. This would be a small scale program to extend the mean width of the beach up to 45 feet to primarily provide protection for property. Roughly 500,000 cubic yards of sand could be required for beach building at a cost in the range of \$2.5 million. Beach width could be maintained with a small annual volume of sand at minor cost. It is estimated that the economic benefits from property protection and recreation would exceed costs of the program within 10 years. In the long term, economic benefits will substantially exceed costs.
2. Evaluate the limiting effects on beach attendance from overcrowding on the beach, and from parking and access problems, for Ocean, Mission and Pacific Beaches and determine the feasibility and cost effectiveness of beach building and maintenance programs to meet recreational needs. Design and carry out a cost-effective beach building and maintenance program for these beaches if it is determined that recreational beach use will increase as a result, and that an acceptable parking and access program can be developed to accommodate additional beach users.
 - a. The initial volume of sand needed for beach building to accommodate potential recreational demand in the Mission Bay littoral cell could be as much as 6.2

million cubic yards and cost in the range of \$31 million. Beach maintenance could require about 5,000 cubic yards per year at an annual cost in the range of \$25,000. The economic benefits of the increased recreational use of these beaches would exceed the costs of the beach building program in the first year and the long term economic benefits would exceed costs substantially if beach use increases as assumed.

- b. A potential major source of sand for the beach building and maintenance program is an offshore borrow site off Mission Beach (estimated 192,000,000 cubic feet of sand). Other potential sand sources include an onshore borrow site in the San Diego River, and Mission Bay dredging. Figure 9 identifies the major sand sources for this cell.
- c. The design of the beach building and maintenance program should include consideration of: the relationship of beach width to shoreline retreat and amount of beachfill needed; the relationship of alongshore to offshore sand transport rates and amount of beachfill needed; variations in annual mean beach width, and in seasonal changes in beach width within the littoral cell; the need for groins or offshore breakwaters in particular areas to regulate the movement of sand up and down coast; the level of property protection, recreation demand accommodation and beach width desired; the role of development regulation and shoreline protective devices in reducing the need for beach building and maintenance in particular areas; safety, water use liability issues related to shoreline management structures; the matching of sand at borrow sites with the needs of nearby beaches; locations for beachfill placement; effects on surfing conditions; environmental impacts on water quality, plant and animal species and their habitats; and the start date for the program. Finally, the program design should be flexible to respond to changing shoreline conditions and new information.

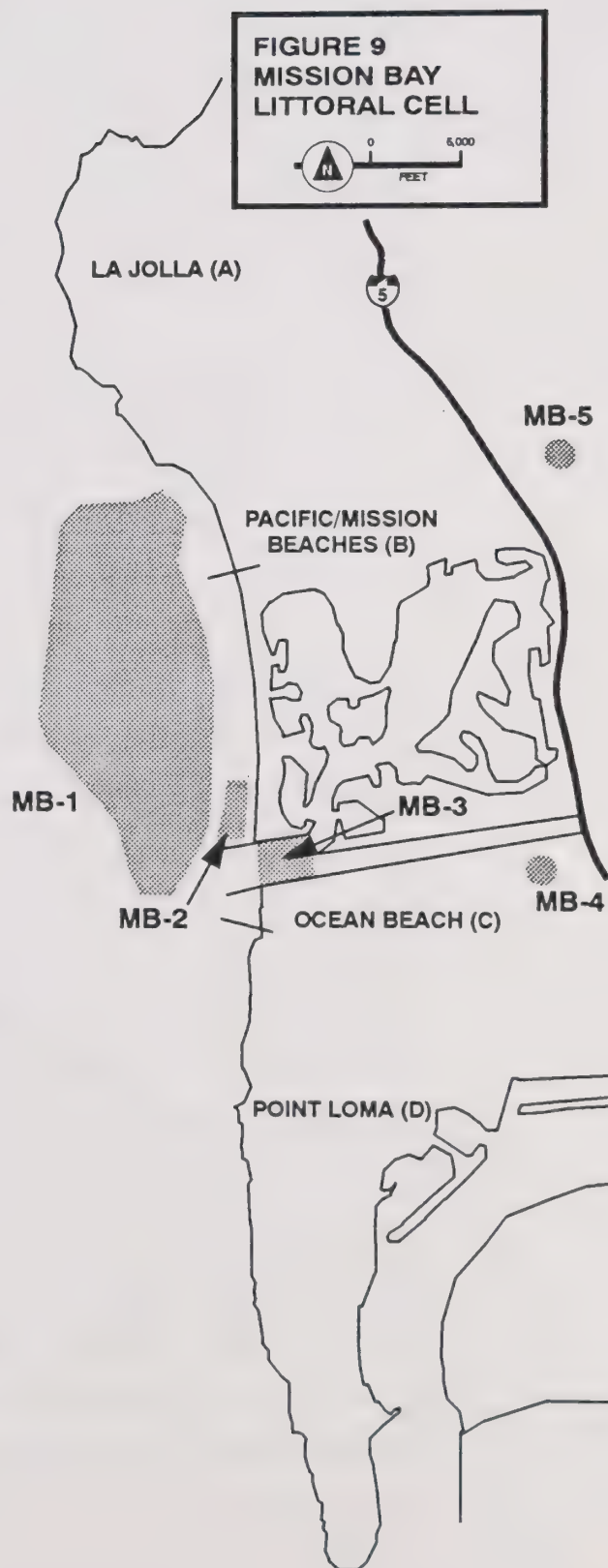
POTENTIAL SAND SOURCES FOR BEACH BUILDING AND MAINTENANCE

<u>Source</u>	<u>Estimated Volume In Cubic Yards</u>
MB-1 (Offshore Pacific and Mission Beaches)	192 million
MB-2 (Collection of sand moving offshore at Mission Bay North Jetty)	11,000/yr.
MB-3 (Mission Bay dredging)	20,000/yr.
MB-4 (San Diego River, east of mapped area)	2.8 million
MB-5 (In the following water storage reservoirs: Cuyamaca, Chet Harritt)	3.4 million

Not shown on this map: water storage reservoirs, development grading and other upland sources.

Notes:

- Volumes are rough estimates which should be refined in designing a beach building and maintenance program.
- Source of estimated volumes is the U.S. Army Corps of Engineers Coast of California Study, Draft State of the Coast Report, October 1, 1990 (The estimates for offshore volumes are based on a 1983 report prepared for the California State Department of Boating and Waterways titled "Potential Offshore Sand and Gravel Resources of the Inner Continental Shelf of Southern California") and the Scripps Institute Center for Coastal Studies (1991 estimates of volumes in listed water storage reservoirs, unpublished).
- Volumes of sand needed for the recommended beach building and maintenance program in this cell: Initial Fill: 500,000 to 6.7 million cubic yards, Annual Maintenance: 5,000 cubic yards.



3. Determine the feasibility and cost effectiveness of capturing sand at the southern end of Mission Beach near the San Diego River jetty and backpassing it to the north where beaches are narrower. Design and carry out a backpassing project if it is a feasible and cost-effective method of supplementing the beach building and maintenance program.

Oceanside Littoral Cell

1. Design and carry out a cost-effective beach building and maintenance program for the southern half of the cell, from Oceanside Harbor south to La Jolla.
 - a. The initial volume of sand needed for beach building in this area could be as much as 25 million cubic yards and cost in the range of \$126 million. Maintenance could require as much as 320,000 cubic yards of sand per year at an annual cost in the range of \$1.6 million. It is estimated that the economic benefits from property protection and recreation will exceed the costs of the beach building and maintenance program within 2 years. Over the long term, economic benefits will substantially exceed costs.
 - b. The major sources of sand for the beach building and maintenance program include eight offshore borrow sites located along the shoreline from Oceanside Harbor south to La Jolla (estimated 112 million cubic yards of sand). Other potential sand sources include onshore borrow sites in various rivers and coastal terraces, and dredge material from the Batiquitos Lagoon enhancement project. Figure 10 identifies the major sand sources for this cell.
 - c. The design of the beach building and maintenance program should include consideration of: the sand bypassing projects already in effect at Oceanside Harbor and Agua Hedionda Lagoon; the relationship of beach width to shoreline retreat and amount of beachfill needed; the relationship of alongshore to offshore sand transport rates and amount of beachfill needed; variations in

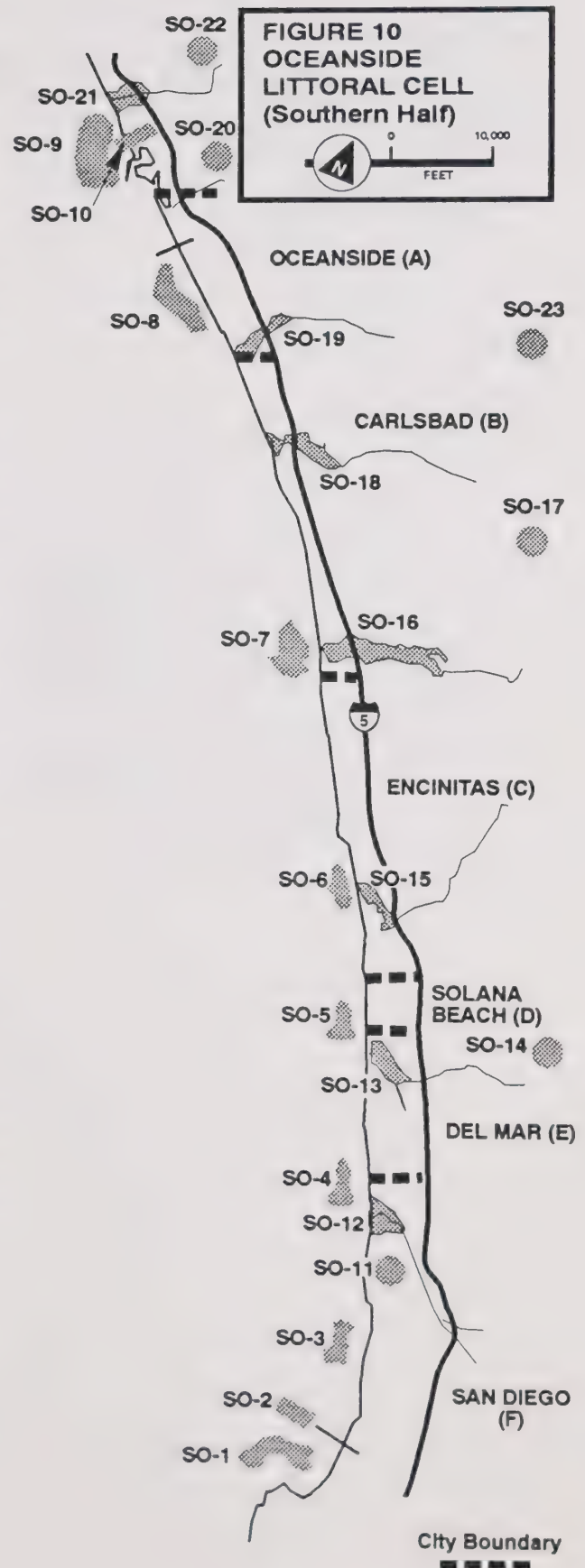
POTENTIAL SAND SOURCES FOR BEACH BUILDING AND MAINTENANCE

Source	Estimated Volume In Cubic Yards
SO-1 (Offshore La Jolla)	5 million
SO-2 (Collection of sand moving down Scripps and La Jolla submarine canyons)	30,000/yr.
SO-3 (Offshore Torrey Pines)	3.1 million
SO-4 (Offshore Los Penasquitos Lagoon)	2.9 million
SO-5 (Offshore San Dieguito Lagoon)	10.3 million
SO-6 (Offshore San Elijo Lagoon)	12.4 million
SO-7 (Offshore Batiquitos Lagoon)	16.5 million
SO-8 (Offshore South Oceanside)	27.1 million
SO-9 (Offshore North Oceanside)	32.6 million
SO-10 (Collection of sand moving offshore at North Oceanside Harbor Jetty)	146,000-440,000/yr.
SO-11 (Los Penasquitos and Soledad Creeks)	61 million
SO-12 (Los Penasquitos Lagoon Enhancement)	Unknown
SO-13 (San Dieguito Lagoon Enhancement)	Unknown
SO-14 (San Dieguito Terrace, east of mapped area)	34.8 million
SO-15 (San Elijo Lagoon Enhancement)	Unknown
SO-16 (Batiquitos Lagoon Enhancement)	2.7-3.7 million
SO-17 (San Marcos Terrace, east of mapped area)	46.5 million
SO-18 (Agua Hedionda Lagoon Enhancement)	Unknown
SO-19 (Buena Vista Lagoon Enhancement)	Unknown
SO-20 (San Luis Rey River, east of mapped area)	2.8 million
SO-21 (Santa Margarita Marsh Enhancement)	Unknown
SO-22 (Santa Margarita River, east of mapped area)	34.8 million
SO-23 (In the following water storage reservoirs: Hodges, Henshaw, Wohlford, San Dieguito, Sutherland)	27.5 million

Not shown on this map: water storage reservoirs, development grading and other upland sources.

Notes:

- Volumes are rough estimates which should be refined in designing a beach building and maintenance program.
- Source of estimated volumes is the U.S. Army Corps of Engineers Coast of California Study, Draft State of the Coast Report, October 1, 1990 (The estimates for offshore volumes are based on a 1983 report prepared for the California State Department of Boating and Waterways titled "Potential Offshore Sand and Gravel Resources of the Inner Continental Shelf of Southern California") and the Scripps Institute Center for Coastal Studies (1991 estimates of volumes in listed water storage reservoirs, unpublished)
- Volumes of sand needed for the recommended beach building maintenance program in this cell: Initial Fill: 25 million cubic yards, Ar Maintenance: 320,000 cubic yards.



annual mean beach width, and in seasonal changes in beach width within the littoral cell; the need for groins or offshore breakwaters in particular areas to regulate the movement of sand up and down coast; the level of property protection, recreation demand accommodation and beach width desired; the role of development regulation and shoreline protective devices in reducing the need for beach building and maintenance in particular areas; safety, water use and liability issues related to shoreline management structures; the matching of sand at borrow sites with the needs of nearby beaches; locations for beachfill placement; effects on surfing conditions; environmental impacts on water quality, plant and animal species and their habitats; and the start date for the program. Finally, the program design should be flexible to respond to changing shoreline conditions and new information.

2. Determine the feasibility and cost effectiveness of capturing sand before it is lost down Scripps Submarine and La Jolla Canyons, and backpassing it to upcoast areas with narrow beaches. Design and carry out a backpassing project if it is a feasible and cost-effective method of supplementing the beach building and maintenance program.
3. Determine the feasibility and cost effectiveness of capturing sand before it moves offshore of Oceanside Harbor, and bypassing it to downcoast areas with narrow beaches. Design and carry out a bypassing project if it is a feasible and cost-effective method of supplementing the beach building and maintenance program and the existing Oceanside Harbor bypassing project.

REGIONWIDE

1. Develop guidelines for the acceptable composition of beachfill material from all sand sources considered in the Shoreline Preservation Strategy, for use by the appropriate state, federal, and local regulatory and planning agencies. The type, composition

and location of placement of dredge material should be carefully determined to maximize the amount of sand that gets to beaches.

2. Develop regional guidelines for the regulation of shoreline land use and protective structures by local jurisdictions which encourage the use of setbacks from beaches and seacliffs and beach building over the use of seawalls and revetments to protect property.
 - a. The guidelines should provide for local flexibility in implementation based on local conditions and existing commitments. Given the wide range of local situations, each local jurisdiction should develop its own standards and guidelines consistent with the regional guidelines. There could be provisions for the use of visually unobtrusive protective structures in combination with beach building where cost effective, and for the use of protective structures where the use of setbacks and beach building are infeasible and where buildings or major public improvements such as roads are in imminent danger.
3. Review harbor, bay and lagoon dredging proposals to ensure that beach compatible dredge material is incorporated in the beach building and maintenance programs recommended for each littoral cell. This action constitutes implementation of the Regional Dredging policy approved in May, 1991.
4. Review of water storage and reservoir studies and projects to encourage consideration of using beach compatible sediment from these sources as beachfill.
5. Determine the feasibility and cost effectiveness of requiring the placement of beach compatible material from land development grading at the region's beaches. Develop regional guidelines for use by local jurisdictions in using this source of sand in the beach building and maintenance programs recommended for each littoral cell, if feasible and cost effective.

6. Develop guidelines for the use of temporary methods of protecting shoreline property from storm damage, such as improved storm warning programs, the use of sand bags, and the use of temporary sand berms, for use by appropriate state, federal, and local agencies.
7. Determine the feasibility and cost effectiveness of using beach compatible dredge material from lagoon and estuary enhancement projects in the region's beach building and maintenance program, as enhancement projects are planned. Incorporate sand from lagoon and estuary enhancement projects in the beach building and maintenance programs recommended for each littoral cell, if feasible and cost effective.
8. Determine the feasibility and cost effectiveness of transporting sand from reservoirs, riverbeds (including commercial sandpits) and debris catch basins to the region's beaches. This evaluation should include The Tijuana River and Rodriguez Reservoir in Mexico. Design and carry out a program of projects which incorporate these sources of sand in the beach building and maintenance programs recommended for each littoral cell, if feasible and cost effective.
9. Develop guidelines for land use planning, regulation and development which encourage the continued contribution of sand to the region's beaches from natural sources such as seacliffs, coastal terraces and ravines, and upland sources. These guidelines should be coordinated with other land use planning programs and policies in the region such as open space planning efforts, and should be used by appropriate state, federal, and local agencies.
10. Determine the capacity of local transportation and parking facilities to accommodate increases in recreational beach use which will be provided for by the beach building and maintenance programs recommended for each littoral cell. Local jurisdictions and state and federal agencies should use this information to identify parking and access problems and to develop solutions, emphasizing transit.

11. Design and carry out a regional shoreline monitoring program to evaluate the effectiveness of the recommended actions.
 - a. A minimum, low cost monitoring program would involve aerial photo measurements of beach width annually or semi-annually. Also, the existing wave measuring gauges off the region's coast should be retained by the state and federal agencies operating them. More detailed monitoring efforts may be included in the design of the beach building and maintenance programs developed for each littoral cell, and for specific projects.
12. An annual "State of the Region's Beaches" report should be prepared by SANDAG to describe progress made in implementing the Strategy and identify problem areas that need emphasis.

IMPLEMENTATION

1. PHASE I: EARLY ACTION PROGRAM

(July 1991 through June 1992, using existing funds and modest new funding sources)

- a. The Shoreline Erosion Committee and SANDAG will secure approval of the Shoreline Preservation Strategy by local, state, and federal agencies.
- b. The Shoreline Erosion Committee and SANDAG, working with local jurisdictions and state and federal agencies, will coordinate the securing of financing (see financing recommendations) for:
 - the design of the beach building and maintenance programs recommended for the three littoral cells; and

- the completion of the studies and guidelines in the regionwide recommendations.
- c. The Shoreline Erosion Committee and SANDAG will coordinate the development of cooperative arrangements among local jurisdictions and state and federal agencies necessary to finance and implement the beach building and maintenance programs and regionwide recommendations (see institutional arrangements recommendations).
- d. The Shoreline Erosion Committee and SANDAG, working with local, state, and federal agencies, will coordinate the Shoreline Preservation Strategy Financing Program contained in the financing recommendations.
- e. The Shoreline Erosion Committee and SANDAG will complete the following regional recommendations, and local jurisdictions, and state and federal agencies will consider them for incorporation in their policies, regulations and action programs:
 - (1) Guidelines for the composition of beachfill material from all sand sources considered in the Strategy.
 - (2) Guidelines for the regional coordination of local regulation of shoreline land use and protective structures.
 - (3) Review of harbor, bay and lagoon dredging proposals to ensure use of compatible dredge material as beachfill (ongoing). (Including disposal sites).
 - (4) Review of water storage and reservoir studies and projects to encourage consideration of using beach compatible sediment from these sources as beachfill.

- (5) Feasibility and guidelines for the use of beach compatible material from land development grading as a source of beach sand.
- (6) Guidelines for the use of temporary property protection methods such as sand berms and sand bags.

2. PHASE II: BEACH BUILDING AND MAINTENANCE PROGRAM DESIGN

(July 1992 through December 1992 using funds secured in Phase I)

- a. The appropriate implementing agencies (see institutional arrangements recommendations) will complete design of the recommended beach building and maintenance programs for the three littoral cells, including detailed cost proposals.
- b. The Shoreline Erosion Committee, SANDAG and involved local, state, and federal agencies will complete as many of the remaining studies and guidelines in the regionwide recommendations (#'s 1 through 6) as funds allow.
- c. Appropriate implementing agencies, with the assistance of the Shoreline Erosion Committee and SANDAG, will secure financing for implementation of the beach building and maintenance programs and regionwide recommendations.

3. PHASE III: CARRY OUT SHORELINE PRESERVATION STRATEGY

(starting January 1993, using funds secured in Phase II)

- a. The appropriate implementing agencies will initiate the beach building and maintenance programs.

- b. Local, state and federal agencies will carry out the regionwide recommendations in support of the beach building and maintenance programs.
- c. The Shoreline Erosion Committee, SANDAG and involved local, state, and federal agencies will complete any of the regionwide recommendations not previously carried out and incorporate the results in the beach building and maintenance programs.
- d. The Shoreline Erosion Committee and SANDAG will coordinate monitoring of the strategy and its periodic evaluation and revision.

FINANCING

(See institutional recommendations for a discussion of responsibilities.)

The costs of Phase I of the implementation program can be met using existing funding and modest additional funds. The costs of Phase II, the design of the recommended beach building and maintenance programs and completion of additional regionwide recommendations, will cost in the range of \$2 million. Several existing and proposed studies including the County Water Authority's evaluation of water storage capacity options, and U.S. Army Corps of Engineers reconnaissance studies of potential solutions to shoreline erosion problems in the Silver Strand and Mission Bay littoral cells will assist the completion of some of the regionwide recommendations. The costs of Phase III, the carrying out of the beach building and maintenance programs for each littoral cell, could cost in the range of \$150 million for initial beach building. The long-term annual costs for the full beach building and maintenance programs could be in the range of \$5 million per year. This does not include the costs of beach maintenance which are the responsibility of the entity managing the beach.

1. Traditional state and federal funding sources such as the State Department of Boating and Waterways, the Coastal Conservancy and State Bond Act grants and loans, and

federal assistance through the U.S. Army Corps of Engineers should continue to be pursued by organizations implementing the Shoreline Preservation Strategy. Special sources of state and federal funds that may become available from time to time through agencies such as the California Coastal Commission, State Lands Commission, the federal Environmental Protection Agency, and the National Oceanic and Atmospheric Administration should also be pursued. It is anticipated that state and federal funds will cover only a portion of the total financing needs.

2. The financing program should be developed on a regional basis to ensure equity and to build understanding and support.
3. The financing program should be designed to provide for the high front end costs of beach building and should be flexible to allow for the setting of priorities where program needs exceed funds available, and to incorporate new sources of financing as they become available. It should recognize that a major portion of the needed funds will have to come from local sources. Finally, the program should provide for long-term financing through the issuance of bonds or similar instruments, to support the high front end costs of beach filling.
4. Shoreline property in the areas of the region where the beach building and maintenance programs are focused will receive major benefits from the program results, both directly from property protection and indirectly in terms of property value. A financing mechanism which targets shoreline property for an equitable share of the needed funds should be instituted.
 - a. The most appropriate financing mechanism to obtain funds from shoreline property is an assessment district. The applicability of the various assessment districts authorized by state law should be reviewed and an assessment district(s) should be created for shoreline property.

- b. State and federal agencies owning shoreline property should contribute funds for the beach building and maintenance program in proportion to other properties which are subject to assessment.
5. It is estimated that visitors to San Diego County account for about 20% of the region's beach users. A financing mechanism which collects an equitable share of the needed funds from visitors should be implemented. An increase in the region's transient occupancy taxes should be instituted for this purpose.
6. San Diego County residents and businesses benefit substantially from living close to the region's shoreline. They benefit directly from their use and enjoyment of beaches and parks, and indirectly in terms of property value and economic activity. A financing mechanism which targets residents for an equitable share of funds should be instituted.
- a. There are several potential financing mechanisms that can be used to collect funds from residents. They include assessment district(s), a parcel tax, an increase in the local sales tax and an increase in the property tax.
 - b. A regional impact fee on new development for its fair share of costs could be considered.
 - c. Creation of a utility by local agencies which could charge fees for shore and beach services could be considered. This innovative financing method has been used by several local agencies in the U.S.
 - d. A surcharge on water rates for the region's households and businesses, implemented through the County Water Authority (CWA) and water providing agencies, might also be considered. This mechanism links financing the program with one of the main factors in the shortage of beach sand in many areas -- the water storage reservoirs that trap sand and regulate water flow that

could move existing downstream sand to the beaches. This financing mechanism requires additional legal analysis and consultation with the CWA.

7. Financing of the Shoreline Preservation Strategy should be coordinated with other Open Space and Natural Resource Financing needs and programs through the Regional Growth Management Strategy being developed by SANDAG.

INSTITUTIONAL

1. The Shoreline Erosion Committee and SANDAG should continue to coordinate shoreline preservation activities for the region, including the development of the beach building and maintenance programs for the region's three littoral cells, the regionwide financing program, and the cooperative arrangements needed to implement the Strategy.
2. Local jurisdictions and state and federal agencies will be responsible for a number of implementation actions, as specified in the recommendations.
3. The interjurisdictional nature of the recommended beach building and maintenance programs for the region's three littoral cells, and the significant amount of funds to be raised and expended to carry these programs out will require additional cooperative intergovernmental arrangements for implementation.
 - a. The purpose of additional arrangements would be to formalize joint decision making about the implementation of the Shoreline Preservation Strategy for each littoral cell, and to provide a mechanism for financing.
 - b. The format of additional arrangements in each littoral cell could range from the designation of a lead agency and the signing of a Memorandum of Agreement, to the formation of a joint powers agency or shoreline authority to carry out implementation in each cell. There may also need to be additional

arrangements set up to coordinate financing and implementation on a regionwide basis.

- c. The most appropriate types of intergovernmental arrangements will depend to some extent on the financing mechanisms chosen. The institutional arrangements for implementation of the Strategy should therefore be developed concurrently with the financing program in Phase I of Implementation.

NOTE:

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APPENDIX

DATA, ASSUMPTIONS AND EVALUATION METHODS OVERVIEW

Introduction

This report presents the key data, assumptions and methods proposed for evaluating regional scale shoreline management methods. This information was used by the staff and consultant to prepare the results and conclusions on which the recommendations for protecting and preserving the region's shoreline were based.

Overview of Data and Assumptions

The information and assumptions needed to prepare the evaluation include:

- Beach widths for 1990, 2010 and 2040 for each of 18 shoreline segments.
- Current recreational beach use data for 1989/90, including total annual attendance, peak day attendance, average daily summer attendance, average daily winter attendance and length of the beach for 28 separate beaches.
- Projections of future beach use in 2010 and 2040, for the 18 coastal segments.
- Assumptions used in the beach use projections.
- The daily and yearly distribution of users on the beaches, the proportion of beach users from out of the county, and the assumed beach area per user.

- The economic value of recreational beach use.
- The economic value of beach front and bluff top property.
- San Diego Region shorefront land use estimates.

Overview of Evaluation Method

The evaluation:

- a. Estimated the minimum summer beach width necessary to accommodate projected beach use in each of the 18 shoreline segments in 1990, 2010 and 2040.
- b. Compared the minimum summer beach width estimated in a) above with the projected actual beach width for the 18 shoreline segments for 1990, 2010 and 2040.
- c. Estimated the minimum winter beach width necessary to protect shorefront property from storm damage in each of the 18 shoreline segments in 1990, 2010 and 2040.
- d. Compared the minimum winter beach width estimated in c) above with the projected actual beach width for the 18 shoreline segments.
- e. Determined for which shoreline segments the estimated beach widths to accommodate recreational needs and to protect property exceed the projected actual beach width.
- f. Determined the beach width required to meet recreation and property protection needs.
- g. Estimated the volumes, costs and benefits of three shoreline management alternatives: do nothing, armor the coast and beach building and maintenance.

The results of the analysis are reflected in:

- Maps of beach widening needed for property protection and recreation in each of the 18 shoreline segments for 1990, 2010 and 2040 (also included is a map of mean beach widths in 1990, 2010 and 2040 and of sand sources for the northern half of the Oceanside littoral cell).
- Estimated volumes, costs and benefits of beach building and maintenance.

**ESTIMATED
SAN DIEGO REGION
BEACH WIDTHS*
(Feet)**

<u>Shoreline Segment (Reach)</u>	<u>1990</u>	<u>2010</u>	<u>2040</u>
<u>Silver Strand Cell</u>			
Border (G)	150	100	40
Imperial (F)	150	110	60
Navy - Comm. (E)	210	190	90
Silver Strand (D)	220	210	175
Navy - Amphib (C)	270	265	260
Coronado (B)	560	570	560
Navy - N.I. (A)	640	680	690
<u>Mission Bay Cell</u>			
Ocean Beach (C)	215	200	185
Mission & Pacific Beaches (B)	270	270	270
<u>Oceanside Cell</u>			
<u>Southern</u>			
San Diego (F)	155	130	100
Del Mar (E)	105	75	30
Solana Beach (D)	80	70	35
Encinitas (C)	125	115	90
Carlsbad (B)	105	90	40
Oceanside (A)	55	40	20
<u>Northern</u>			
Camp Pendleton (C)	270	290	295
San Onofre (B)	205	230	250
Orange County (A)	180	140	100

*Estimates are annual averages for the entire reach; in some locations, there are large variations within the reaches. The variations are shown on the maps of Estimated San Diego Region Beach Widths.

Beach width is defined as the distance between mean sea level and a point delineating the back of the beach, such as a road, structure or the base of a seacliff.

Future beach widths do not assume any beach replenishment projects, but do include the effects of the Oceanside Sand Bypass project, and sand bypassing at Agua Hedionda Lagoon.

CURRENT SAN DIEGO REGION RECREATIONAL BEACH USE ESTIMATES

Beach Name (Shoreline Reach)	Annual Attendance	Peak Day Attendance	Daily* Summer Attendance	Daily* Winter Attendance	Beach Length (Linear Shore-Front Feet)
<u>N. OCEANSIDE CELL</u>					
Doheny State Beach (A)	500,000	15,000	3,200	700	6,600
San Clemente City Beach (A)	1,600,000	28,000	9,100	2,300	10,600
San Clemente State Beach (A)	558,000	5,000	1,200	300	6,000
San Onofre State Beach (B)	722,000	12,000	4,300	1,200	24,900
<u>S. OCEANSIDE CELL</u>					
Oceanside City Beach (A)	1,381,000	139,000	16,000	3,500	19,500
Carlsbad State Beach (B)	1,968,000	11,900	9,500	3,500	5,400
South Carlsbad State Beach (B)	811,000	4,900	2,800	1,300	15,200
Leucadia State Beach (Beacon's) (C)	149,000	600	500	400	5,400
Moonlight State Beach (C)	572,000	3,400	2,300	900	1,800
Encinitas City Beaches (C)	299,000	4,000	2,400	500	18,500
San Elijo State Beach (D)	428,000	2,000	1,500	400	9,100
Cardiff State Beach (D)	1,381,000	12,800	7,800	3,400	5,900
Solana Beach City Beaches (D)	1,195,000	36,000	9,600	2,200	6,600
Del Mar City Beach (E)	1,091,000	31,500	7,000	1,400	11,900
Torrey Pines State Beach (F)	1,024,000	12,100	4,600	1,800	8,800
Torrey Pines City Beach (F)	391,000	5,000	2,900	700	1,300
Scripps Beach City Beach (F)	226,000	1,800	1,000	300	1,100
La Jolla Shores City Beach (F)	1,854,000	13,000	7,500	1,300	4,200
<u>MISSION BAY CELL</u>					
La Jolla Cove City Beach (A)	443,000	5,400	3,200	800	200
Casa (Children's Pool) City Beach (A)	354,000	4,100	2,400	500	200
Windansea Beach City Beach (B)	214,000	3,200	1,900	500	2,600
North Pacific Beach City Beach (B)	527,000	13,300	7,700	1,900	2,600
South Pacific Beach City Beach (B)	1,685,000	19,600	11,400	1,600	5,300
Mission Beach City Beach (B)	3,099,000	16,800	9,800	1,300	7,900
Ocean Beach City Beach (C)	1,820,000	31,800	18,500	800	5,300
<u>SILVER STRAND CELL</u>					
Coronado City Beach (B)	600,000	20,000	5,000	800	14,300
Silver Strand State Beach (D)	386,000	4,600	1,800	100	23,500
Imperial Beach City Beach (F)	1,000,000	12,000	5,500	1,300	10,600
Border Field State Park (G)	30,000	500	200	100	6,000
Totals:	26,308,000	454,300	157,300	31,504	241,400

* Daily Summer Attendance is an average of June-September attendance
Daily Winter Attendance is an average of November-February attendance

Sources: Estimates from State and City Departments of Parks and Recreation

**SAN DIEGO REGION
BEACH RECREATION PROJECTIONS
(Annual Users)**

<u>Shoreline Segment (Reach)</u>	<u>1990</u>	<u>2010</u>	<u>2040</u>
<u>Silver Strand Cell</u>			
Border Field reach	30,000	36,600	46,700
Imperial Beach reach	1,000,000	1,220,000	1,556,100
Silver Strand reach	386,000	470,900	600,600
Coronado reach	600,000	732,000	933,700
Cell Total	2,016,000	2,459,500	3,137,100
<u>Mission Bay Cell</u>			
Ocean Beach reach	1,820,000	2,191,200	2,759,900
Mission & Pacific Beach reach	5,311,000	6,394,500	8,054,000
La Jolla Pocket Beaches	1,011,000	1,203,100	1,527,900
Cell Total	8,142,000	9,788,800	12,346,800
<u>Oceanside Cell</u>			
San Diego reach	3,495,000	4,655,300	6,509,900
Del Mar reach	1,091,000	1,453,200	2,032,200
Solana Beach reach	1,195,000	1,591,700	2,225,900
Encinitas reach	2,829,000	3,768,200	5,269,300
Carlsbad reach	2,779,000	3,701,600	5,176,300
Oceanside reach	1,381,000	1,839,500	2,572,300
San Onofre reach	722,000	961,700	1,344,900
Orange County reach	2,658,000	3,540,400	5,094,500
Cell Total	<u>16,150,000</u>	<u>21,511,600</u>	<u>30,225,300</u>
GRAND TOTAL (All 3 Cells)	26,308,000	32,556,800	43,821,300

Sources: 1989/1990 Beach Use Estimates from City and State Park and Recreation Departments. The 2010 and 2040 projections are based on assumptions discussed on the following pages of this attachment.

ASSUMPTIONS USED IN PROJECTING RECREATIONAL BEACH USE

1. Origin of Beach Users

Several surveys of the origin of beach users at San Diego region beaches were taken about 10 years ago*. These surveys indicate that, given a choice among beaches of similar quality, and with similar accessibility, people will attend the beach closest to their residence. The surveys also indicated that about 20% of beach users were from outside the County of San Diego, and that less than 5% were from outside California. These survey results, and more detailed origin and destination studies of several beaches in the region, guided the development of the following assumptions on the origin of beach users that were used in projecting future recreational use of the beaches.

- a. 80% of the users of the region's beaches come from various locations within San Diego County, while 20% come from outside the County. This assumption was applied to all of these littoral cells within the region.
- b. For beach users from within the region, the origin of beach users was distributed among the region's three littoral cells using the major statistical areas (MSA's) that SANDAG uses for the purpose of aggregating demographic information.

Oceanside Littoral Cell: attracts 100% of the beach users from the North County West and North County East MSA's, 50% from the North City MSA, and 33% from the East Suburban and East County MSA's.

Mission Bay Littoral Cell: attracts 50% of the beach users from the North City and Central MSA's and 33% from the East County Suburban and East County MSA's.

Silver Strand Littoral Cell: attracts 100% of the beach users from the South Suburban MSA, 50% from the Central MSA and 33% from the East County Suburban and East County MSA's.

2. Rates of Growth for Recreational Beach Use

- a. It was assumed that the proportion of beach users from origins within and from outside the region would remain the same throughout the forecast period.

*San Diego Regional Coastal Access Study, SANDAG, 1978 Mission Bay Access Study, SANDAG, 1981

- b. The growth rate for beach users from outside the region was the California growth rate, supplied by the State Department of Finance.
- c. The growth rate for beach users from within the region was the SANDAG Series 7 growth rate, weighted and averaged for the beaches in each littoral cell, according to the MSA origins identified in 1b. above.

3. Role of Beach Accessibility

The beach user surveys described previously indicate that traffic and parking problems associated with getting to a beach should adversely affect beach attendance. Before large scale beach building projects are undertaken, solely for their recreational benefits, the potential limitation on the use of the beach due to access problems should be closely reviewed.

ASSUMPTIONS USED IN ESTIMATING RECREATIONAL BEACH NEEDS

Several additional assumptions must be made to determine the amount of beach needed to cost effectively accommodate the current and projected beach users. These assumptions include seasonal and weekly variations in the number of beach users, daily variations in the number of beach users, and minimum beach area needed by the user.

1. Seasonal and Weekly Variations

Assumptions on seasonal and weekly variations in beach users were derived from the seasonal variations reported by State and City Parks and Recreation Departments (see Attachment C). The assumptions are:

- a. There are about 6 peak days per year, summer holiday weekends. About 10% of the total annual beach users are included in these 6 days.
- b. There are about 30 additional summer weekend days per year. The average attendance on these days is about 1.5 times the average regional daily summer attendance. This means that an additional 27% of the total annual beach users are included in these 30 days.
- c. On the 86 week days in the four summer months (June through September) the average daily attendance is about 70% of the regional daily average for that period. About 32% of the total annual beach users would attend on these days.
- d. For the remaining 243 days of the year, the winter month regional daily average attendance would apply. This would result in 31% of total annual beach users attending on these days.

In Summary:

6 peak summer days	- 10% of total attendance
30 summer weekend days	- 27% of total attendance
86 summer week days	- 32% of total attendance
<u>243</u> non-summer days	- <u>31%</u> of total attendance
365 days	100% of total attendance

These assumptions will be used by the Committee to determine what level of beach use (peak day, summer weekend, etc.) should be supported by the region's Shoreline Management program. They can then be used to modify the annual beach use projections to determine beach width required to accommodate recreational demand in future years.

2. Daily Variations

The summary data from the SANDAG Beach access studies cited previously show that beach use is concentrated in the middle of the day. It is estimated that 70% of beach users are on the beach at the same time during the day. This assumption will be used to modify the annual beach use figures to determine beach width required to accommodate recreational demand.

3. Minimum Beach Areas/User

The U.S. Army Corps of Engineers uses 100 sq. ft. (a 10-foot by 10-foot space) as the minimum beach area required to accommodate a single user. It is assumed that when this density of beach attendance is reached people will stay away from the beach. In reality, an increasing percentage of beach users would be deterred as density increased to 100 sq. ft./user. The 100 sq. ft. minimum beach area/user is used in estimating beach area needed to accommodate estimated beach attendance in the Shoreline Preservation Strategy.

ASSUMPTIONS ON THE ECONOMIC VALUE OF RECREATIONAL BEACH USE

The economic value of the recreational beach has two parts; the direct economic benefit to the local economy, and the economic value to beach users that is not directly reflected in the marketplace. The assumptions for both of these values are based on economic analysis work done by David M. Dornbusch & Company related to the impacts of OCS oil development on recreation and tourism.* The Dornbusch analysis was prepared for each of California's coastal counties for beach recreation and tourism, as well as other related topics. The analysis was done using 1982 data. Dollar values have been brought forward to 1990, using the consumer price index growth factor.

1. Direct Economic Value

It is assumed that direct economic benefits will accrue only from beach users from outside the County of San Diego. Tourism is considered a basic industry because it brings in money to our region from areas outside. Spending by beach users from within the County is not considered an economic addition. It is assumed that money not spent at the beach by County residents would be spent in the region for other purposes, with no net effect.

The Dornbusch analysis identified the economic benefits of direct tourist beach user spending, spending by the businesses serving the visitors, (e.g., retail trade, hotels, restaurants, auto services) and the employees of these businesses. The estimated economic benefit to the region per out-of-County beach visitor day is \$55 (1990 \$'s). Approximately \$1 of this total is local government revenue from sales and use taxes and transient lodging taxes.

However, it should be noted that when County residents visit a beach in a jurisdiction in which they do not live, any related spending in the beach jurisdiction represents a gain for that jurisdiction's economy and a loss to the economy of the beach visitors home jurisdiction. At the same time, the local government costs associated with beaches, such as maintenance, trash pick up and traffic and parking problems, should be recognized.

2. Other Economic Value

A portion of the economic value of the beach is not reflected in the direct flow of dollars in the region. It is a "public good" which is not measured by the economy. This does not mean that the beach has no value to people. The beach obviously has great value to San Diegans and tourists alike. One technique economists use to value public goods is to determine how much people are willing to pay in travel costs to use a resource. For beach use this is done by examining how beach user numbers respond to varying travel costs. The Dornbusch analysis estimated a value of \$7.00/person (1990 \$'s) for this value of the beach. This value applies to all beach users.

*Impacts of Outer Continental Shelf Development on Recreation and Tourism, David M. Dornbusch & Company, 1987 (prepared for the Minerals Management Service, U.S. Department of the Interior.

ECONOMIC VALUE OF SHOREFRONT PROPERTY

This information was not available at the May Committee meeting for its discussion of data, assumptions and evaluation methods for the Shoreline Preservation Strategy. It is being distributed at the June 7th meeting. These assumptions were used in estimating the value of property protection for the "Estimated Volumes, Costs and Benefits of Beachfilling" table contained in the June 7th Committee Agenda package.

Recent sales and assessor's information were evaluated for over 40 shorefront properties, from all three littoral cells in the region. Most of the properties were residential, a few were commercial. Only land value was evaluated because in most cases shoreline erosion will affect primarily land and not structures on other improvements. An average estimated shorefront land value of \$110/sq. ft. for 1990 was derived from this evaluation.

Over the past 20 years, property values in the region have increased at an average annual rate of 10.5% per year above the region's consumer price index. This historical rate of appreciation was used to project future appreciation. The 2010 value is \$230/sq. ft. and the 2040 value is \$575/sq. ft. (both in 1990 dollars).

**ESTIMATED
SAN DIEGO REGION
SHOREFRONT LAND USE
(linear feet)**

<u>LITTORAL CELL</u>	<u>LAND USE* CATEGORY</u>	<u>FEET OF SHORELINE</u>
Silver Strand	Residential	1,009
	Institutional	18,334
	Parks/Open Space	34,494
	<u>Vacant</u>	<u>18,495</u>
	Total	72,333
Mission Bay	Residential	12,098
	Commercial	384
	Parks/Open Space	7,830
	<u>Water</u>	<u>905</u>
	Total	21,217
South Oceanside	Residential	38,026
	Commercial	832
	Institutional	3,285
	Commercial Recreation	16,273
	Parks/Open Space	47,084
	Agricultural	27
	Vacant	36,267
	<u>Water</u>	<u>216</u>
North Oceanside (within San Diego County)	Total	142,010
	Communications/Utilities	4,656
	Institutional	2,014
	Parks/Open Space	24,727
	<u>Vacant</u>	<u>59,901</u>
	Total	91,208

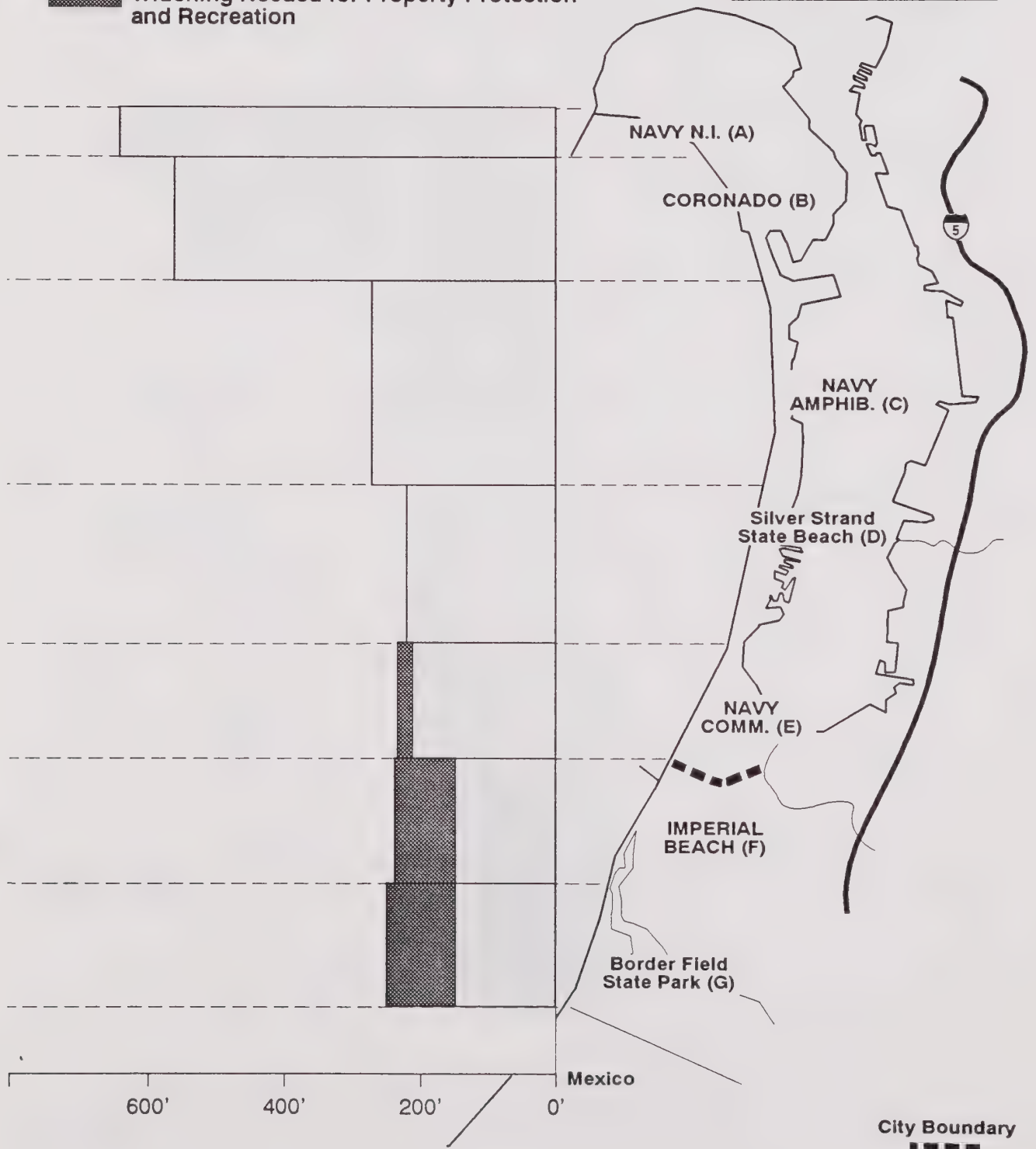
* Based on 1986 Land Use

**MAPS OF BEACH WIDENING NEEDS
IN 1990, 2010 AND 2040**

BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 1990 NEEDS

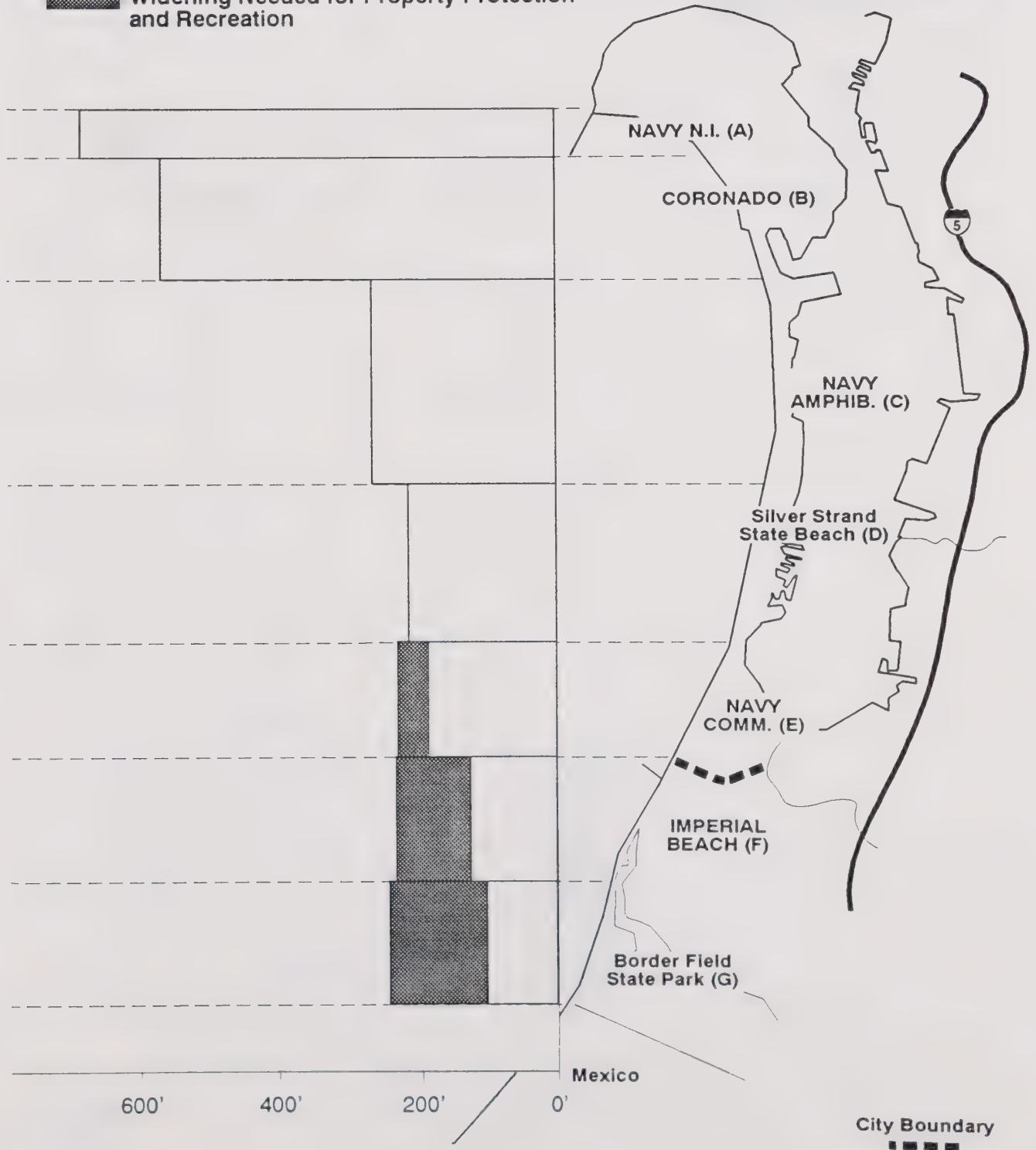
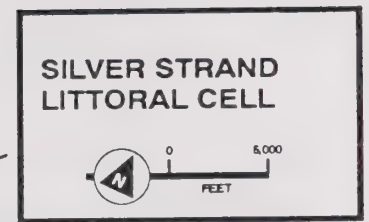
SILVER STRAND LITTORAL CELL

- Estimated Annual Mean Beach Width
- Widening Needed for Property Protection and Recreation



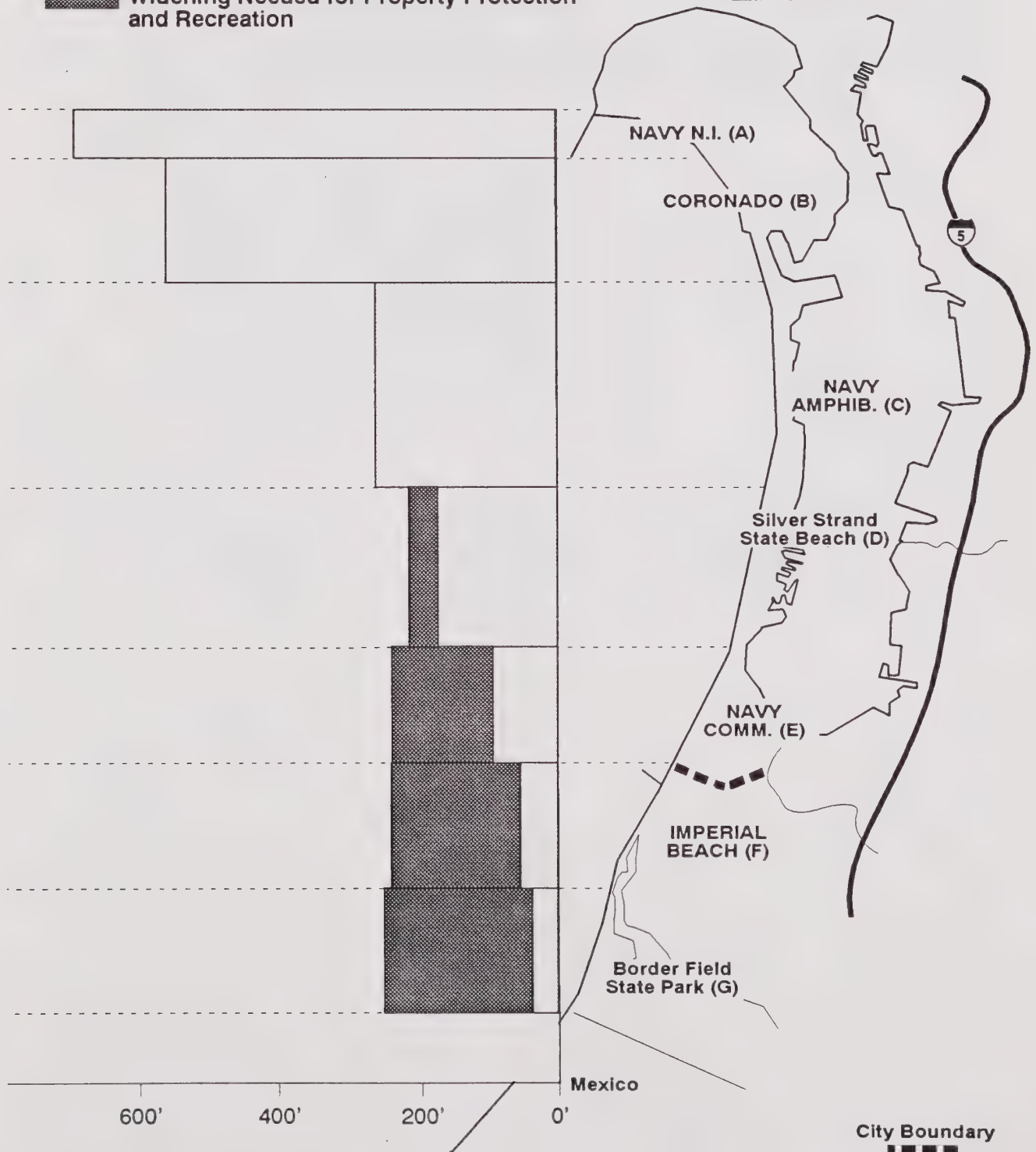
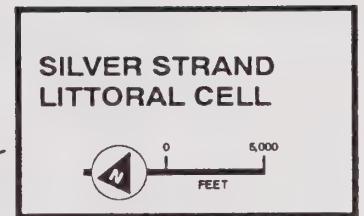
BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 2010 NEEDS

- Estimated Annual Mean Beach Width
- Widening Needed for Property Protection and Recreation

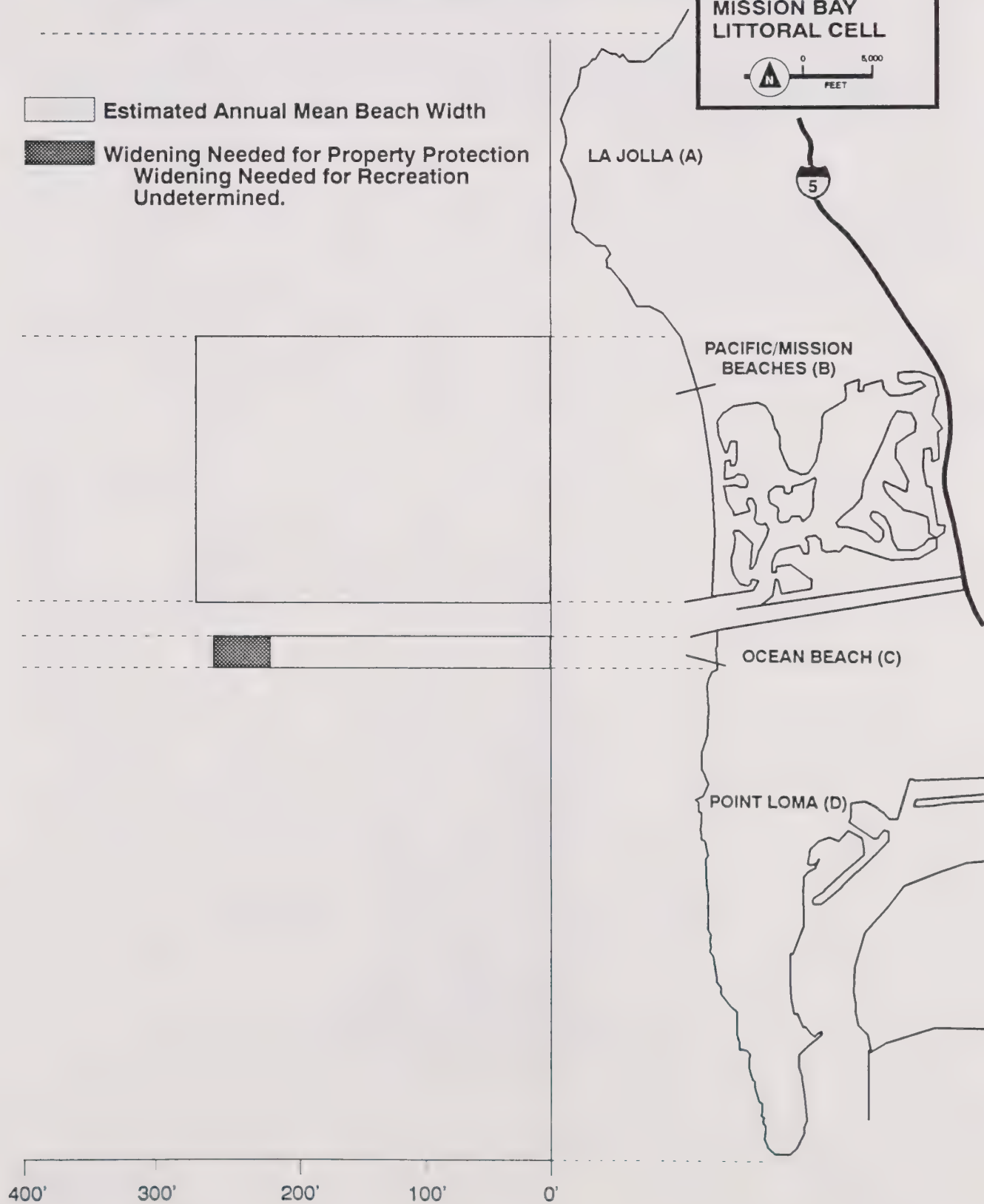


BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 2040 NEEDS

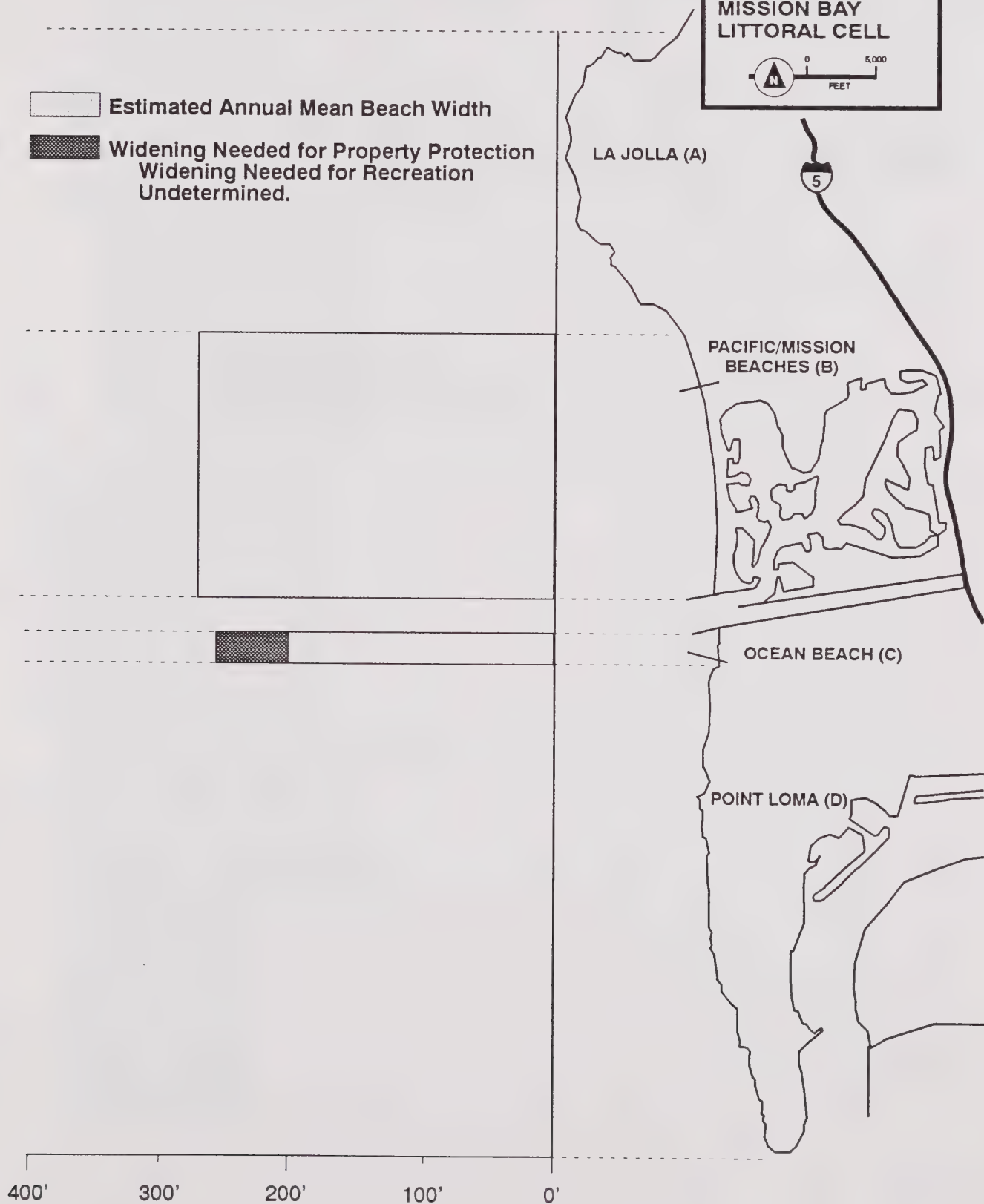
- Estimated Annual Mean Beach Width
- Widening Needed for Property Protection and Recreation



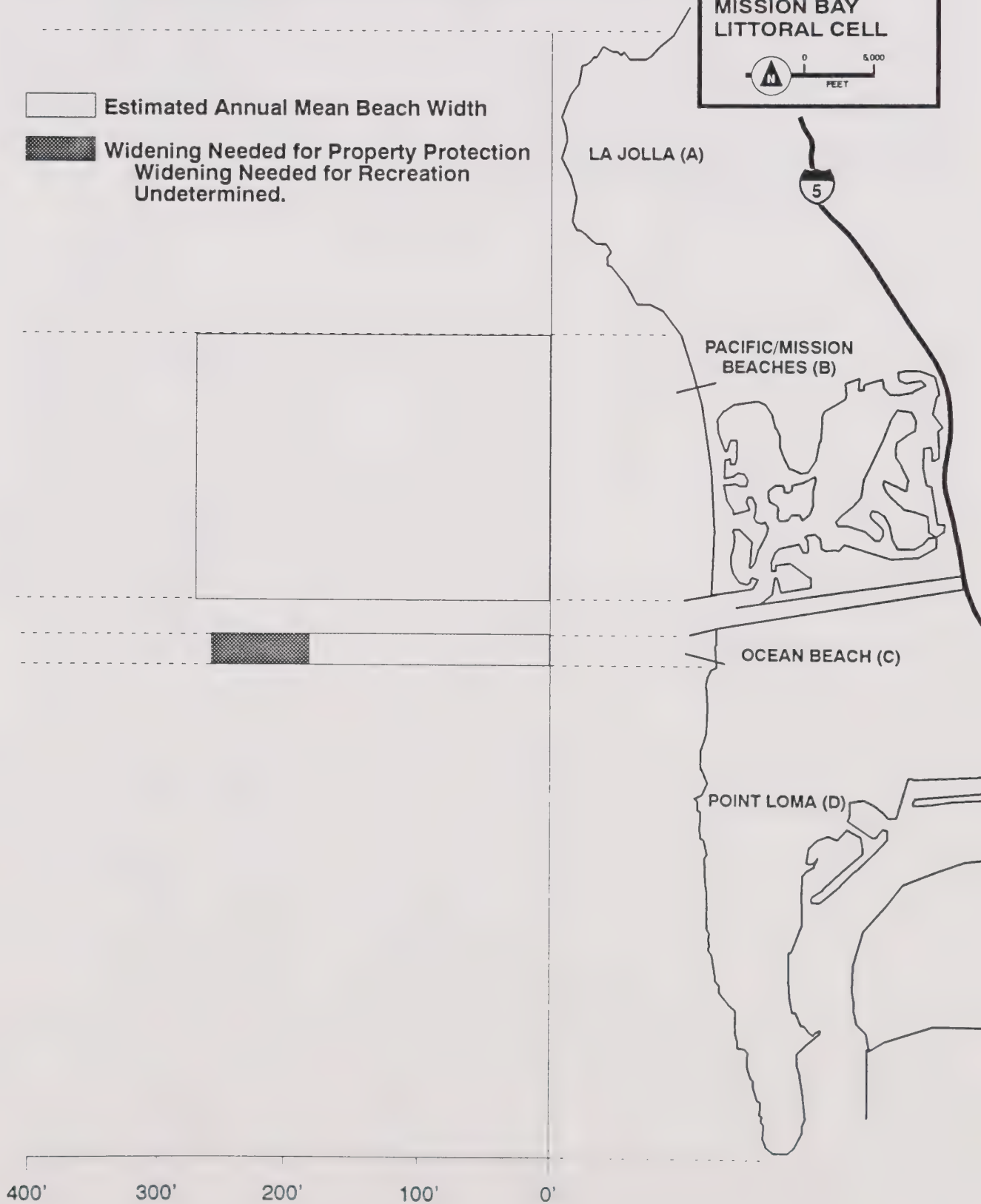
BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 1990 NEEDS



BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 2010 NEEDS

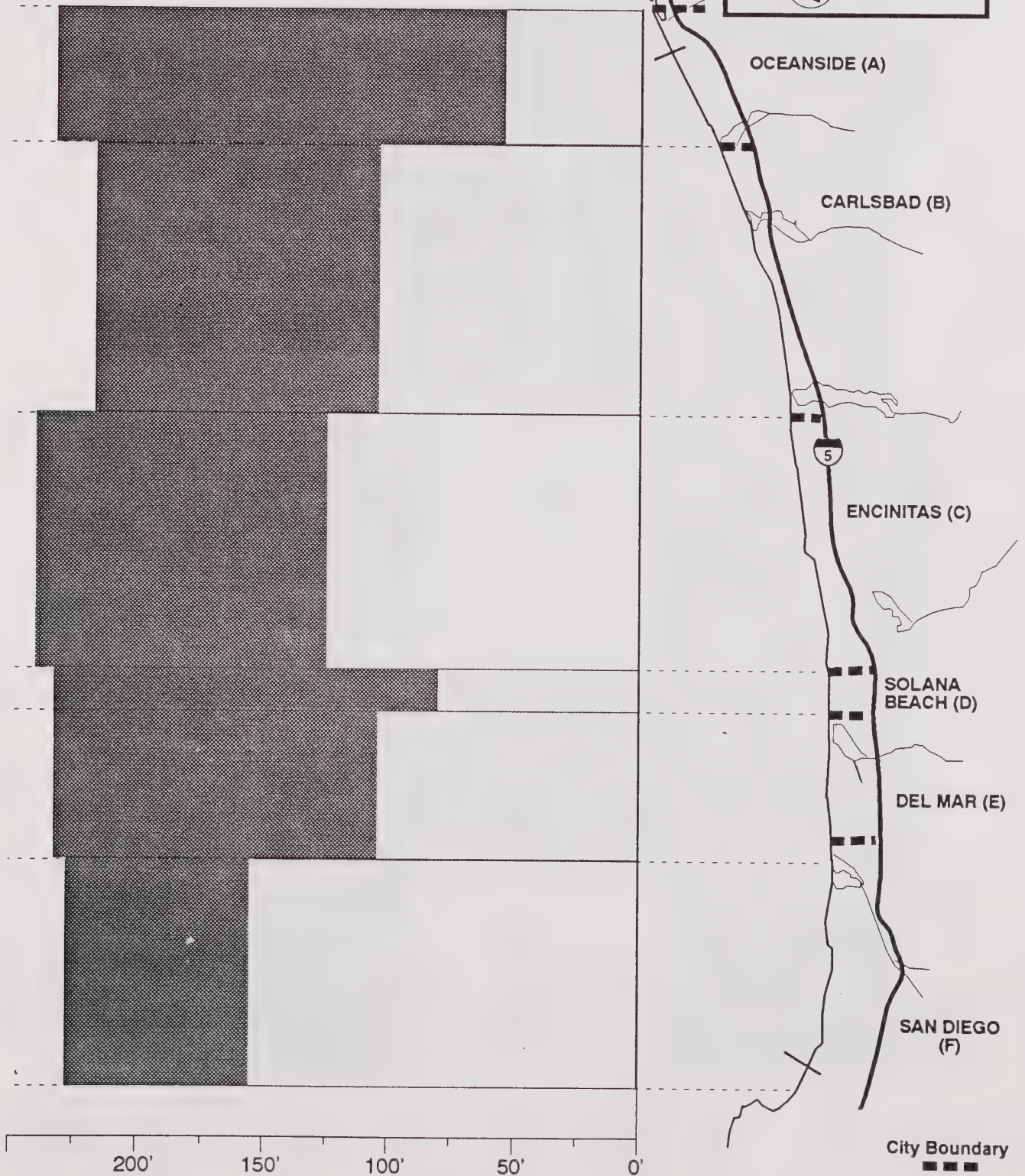
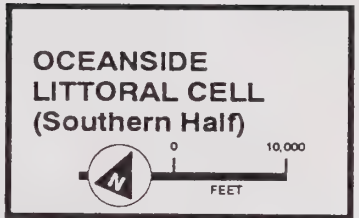


BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 2040 NEEDS



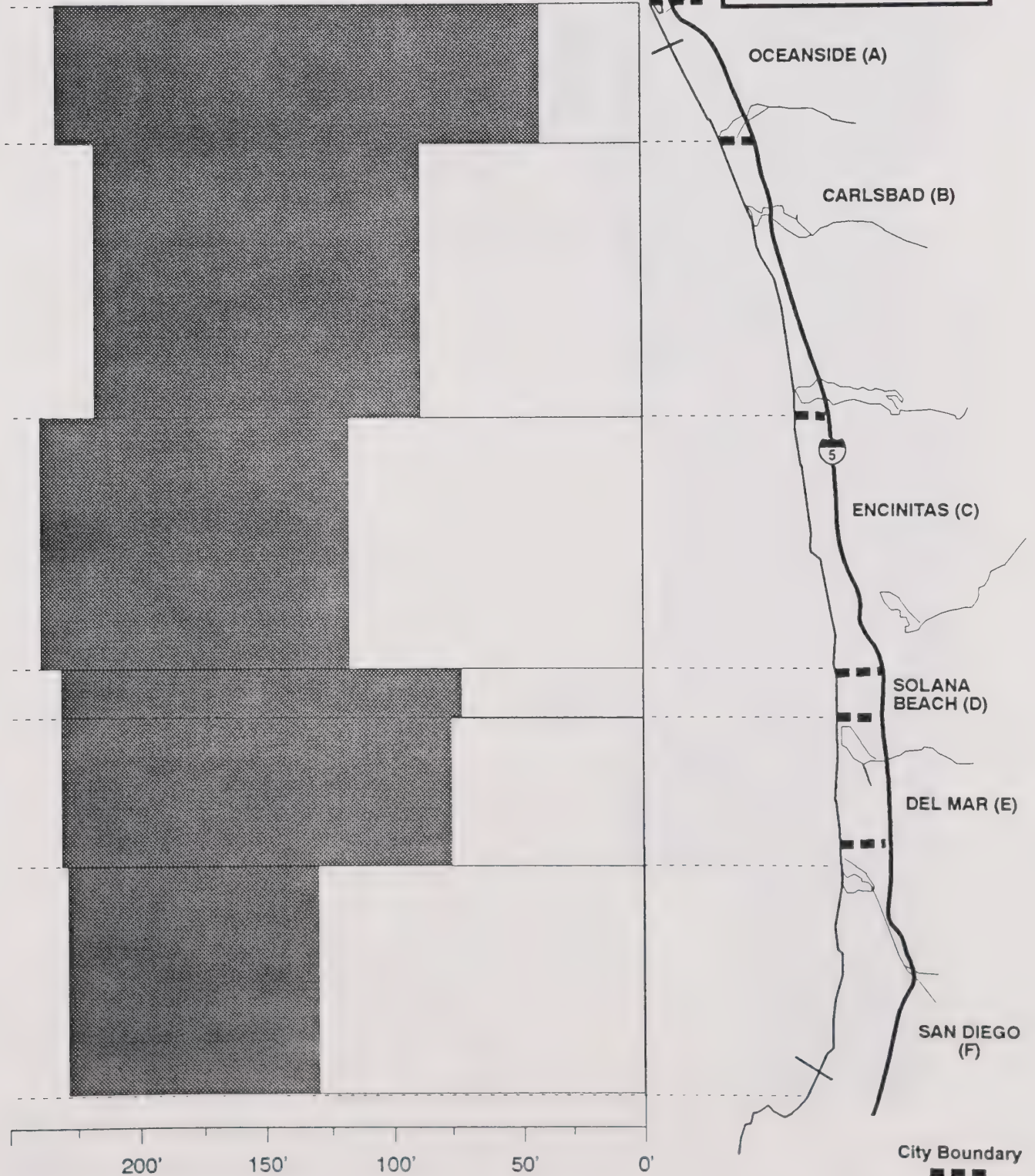
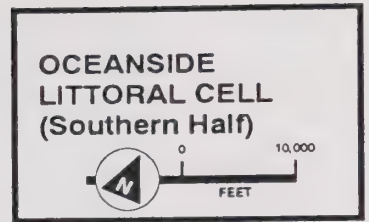
BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 1990 NEEDS

- Estimated Annual Mean Beach Width
- Widening Needed for Property Protection and Recreation



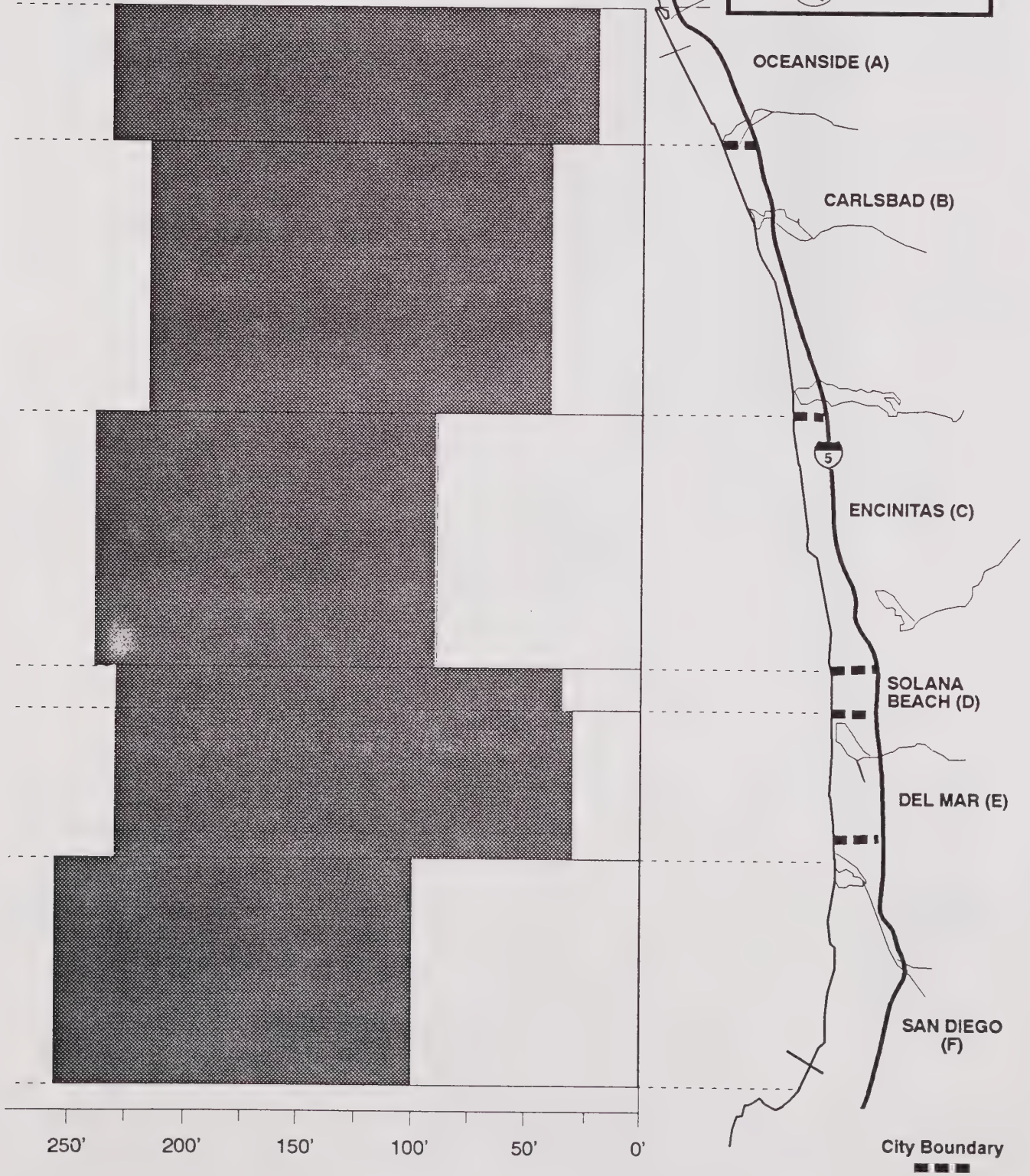
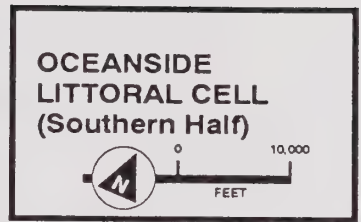
BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 2010 NEEDS

- Estimated Annual Mean Beach Width
- Widening Needed for Property Protection and Recreation



BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 2040 NEEDS

- Estimated Annual Mean Beach Width
- Widening Needed for Property Protection and Recreation



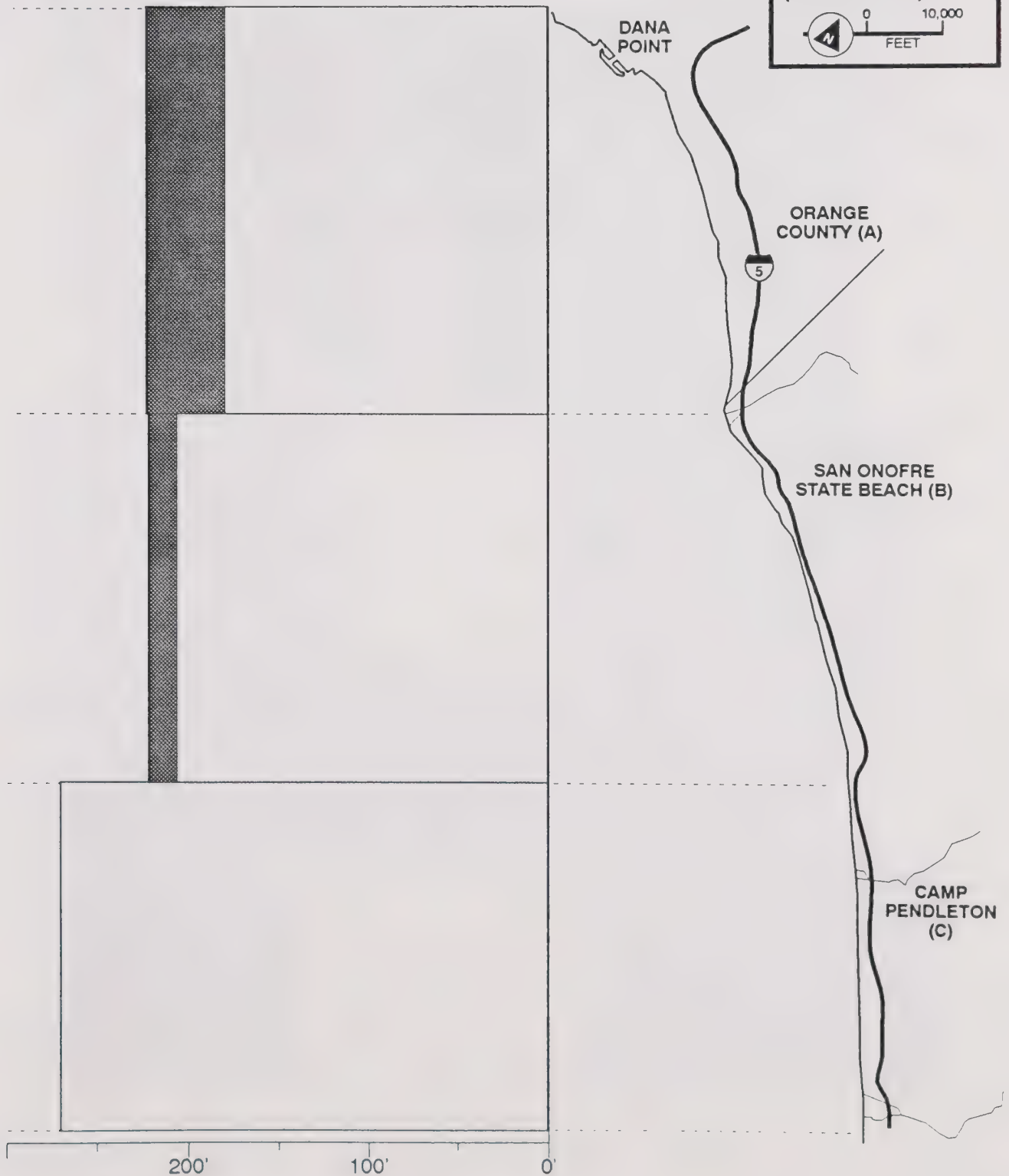
BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 1990 NEEDS

 Estimated Annual Mean Beach Width

 Widening Needed for Property Protection and Recreation

OCEANSIDE
LITTORAL CELL
(Northern Half)

0 10,000
FEET

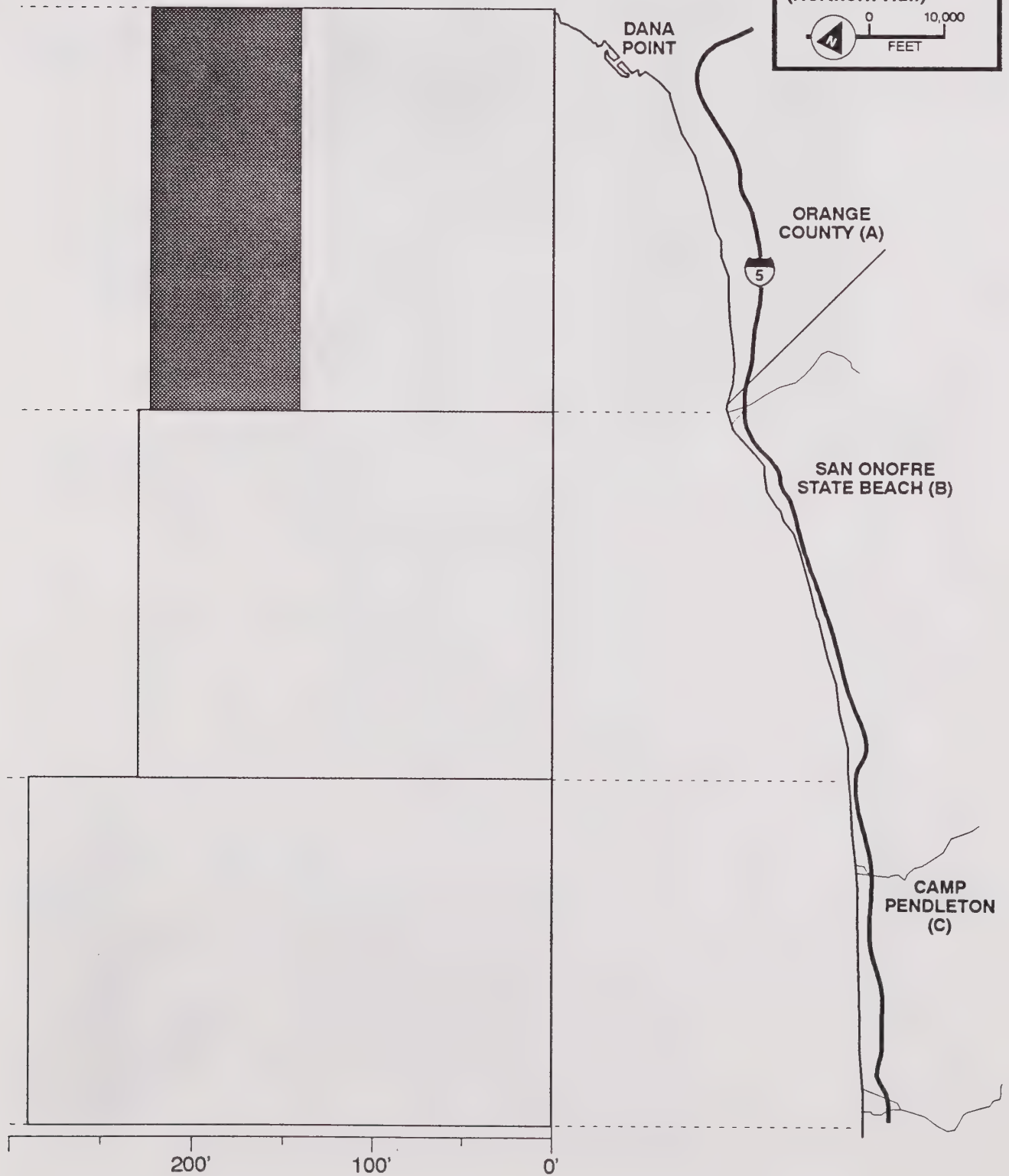


BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 2010 NEEDS

 Estimated Annual Mean Beach Width

 Widening Needed for Property Protection and Recreation

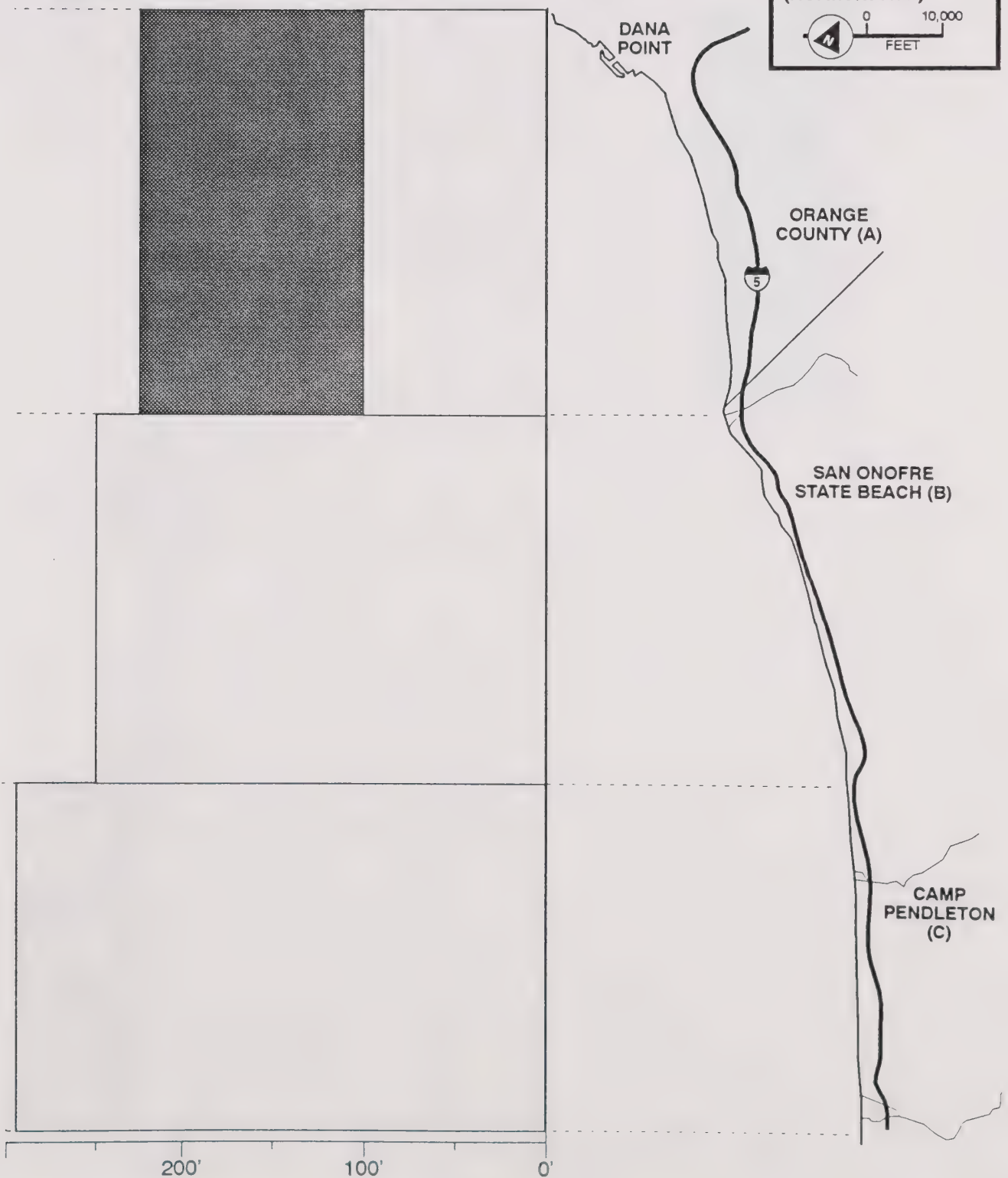
OCEANSIDE
LITTORAL CELL
(Northern Half)



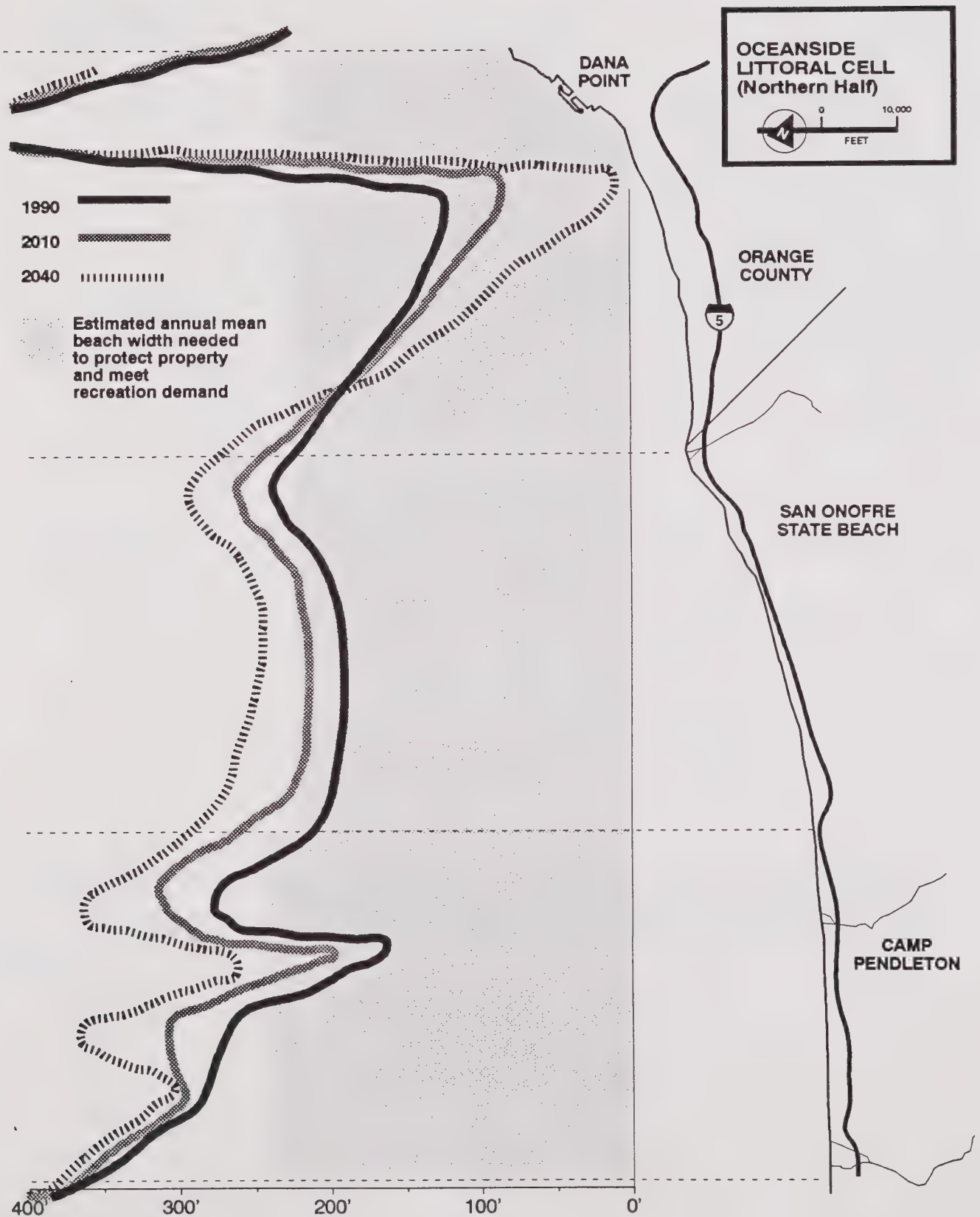
BEACH WIDENING FOR PROPERTY PROTECTION AND RECREATION - 2040 NEEDS

 Estimated Annual Mean Beach Width

 Widening Needed for Property Protection and Recreation



ESTIMATED ANNUAL MEAN BEACH WIDTHS



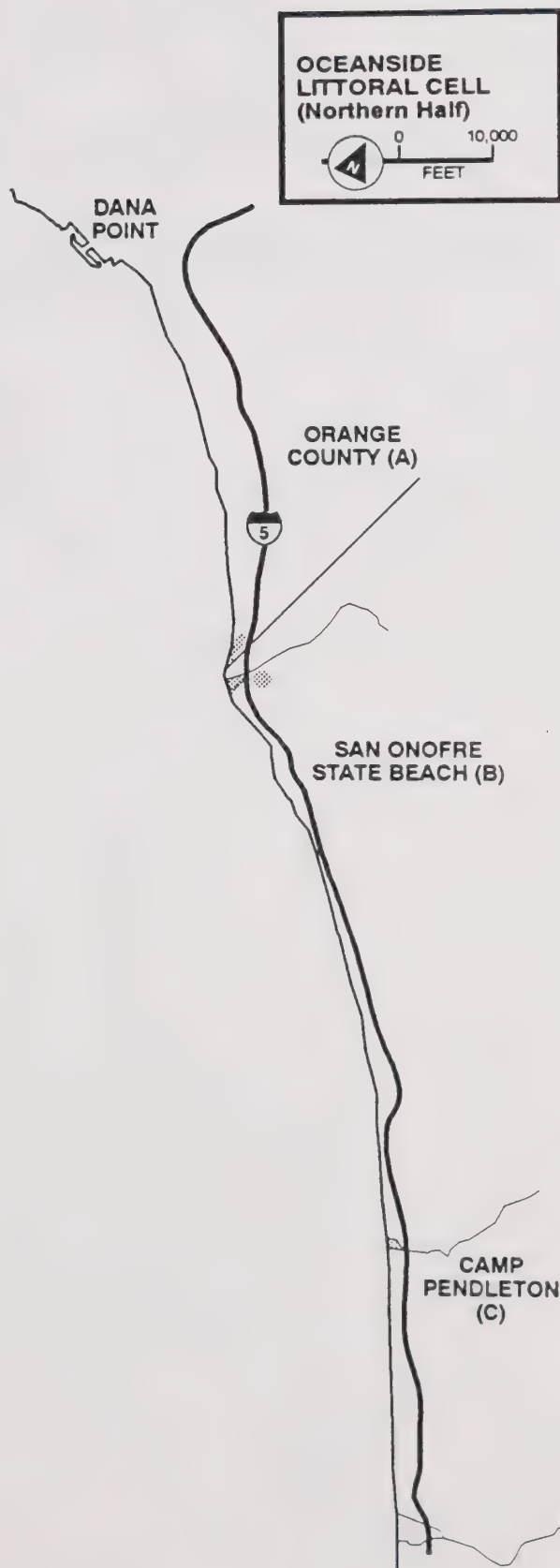
POTENTIAL SAND SOURCES FOR BEACH BUILDING AND MAINTENANCE

Source	Estimated Volume in Cubic Yards
NO-1 (Las Flores Marsh Enhancement)	Unknown
NO-2 (San Mateo Marsh Enhancement)	Unknown
NO-3 (San Onofre River)	29 million
NO-4 (San Clemente Terrace)	5.8 million

Not shown on this map: water storage reservoirs,
development grading and other upland sources.

Notes:

- Volumes are rough estimates which should be refined in designing a beach building and maintenance program.
- Source of estimated volumes is the U.S. Army Corps of Engineers Coast of California Study, Draft State of the Coast Report, October 1, 1990



**ESTIMATED VOLUMES, COSTS AND BENEFITS
OF BEACH BUILDING AND MAINTENANCE**

ESTIMATED
VOLUMES, COSTS AND BENEFITS OF
BEACH BUILDING
AND MAINTENANCE*

<u>Shoreline Reaches</u>	<u>Year</u>	<u>Initial Fill Volume (Cu. Yards)</u>	<u>Annual Maintenance Volume (Cu. yards)</u>	<u>Cost of Initial Fill (1990\$)</u>	<u>Cost of Annual Maint. (1990\$)</u>	<u>50-year Annualized Cost (1990\$)</u>	<u>Recreational Benefit of Beach Fill (1990\$)</u>	<u>Protective Benefit of Beach Fill (1990\$)</u>	<u>Total Benefit of Beach Fill (1990\$)</u>	<u>Benefit/ Cost</u>
SILVER STRAND CELL										
Border field	1990	1.3 x 10 ⁶	39,000	6.5 x 10 ⁶	200,000	330,000	0	55,000	55,000	.2
	2010						0	520,000	520,000	1.6
	2040						0	2.7 X 10 ⁶	2.7 x 10 ⁶	8.2
Imperial Beach	1990	1.3 x 10 ⁶	30,000	6.5 x 10 ⁶	150,000	280,000	0	90,000	90,000	.3
	2010						0	670,000	670,000	2.4
	2040						0	3.2 x 10 ⁶	3.2 x 10 ⁶	11.4
Navy-Communications	1990	380,000	20,000	1.9 x 10 ⁶	100,000	140,000	0	18,000	18,000	0.1
	2010						0	74,000	74,000	.5
	2040						0	2.1 x 10 ⁶	2.1 x 10 ⁶	15.0
Silver Strand	1990	0	1,900	0	10,000	5,000	0	0	0	0.0
	2010						0	23,000	23,000	4.6
	2040						0	170,000	170,000	34.0
Navy-Amphibious	1990	0	0	0	0	0	0	0	0	0
	2010						0	0	0	0
	2040						0	0	0	0
Coronado	1990	0	0	0	0	0	0	0	0	0
	2010						0	0	0	0
	2040						0	0	0	0
Navy-North Island	1990	0	0	0	0	0	0	0	0	0
	2010						0	0	0	0
	2040						0	0	0	0

*The beach fill volumes, benefits and costs for each reach are based on extending the beach to maximum width required to meet design property protection or 100% recreation demand, which ever is greater (see "Estimated Mean Beach Widths" table).

MISSION BAY CELL

Ocean Beach	1990	2.6 x 10 ⁶	2,400	13 x 10 ⁶	12,000	270,000	8.4 x 10 ⁶	11,000	8.4 x 10 ⁶	31.1
	2010						18 x 10 ⁶	36,000	18 x 10 ⁶	66.7
	2040						27 x 10 ⁶	130,000	27 x 10 ⁶	100.0
Mission & Pacific Beaches	1990	3.6 x 10 ⁶	2,500	18 x 10 ⁶	13,000	370,000	5.2 x 10 ⁶	0	5.2 x 10 ⁶	14.0
	2010						6.4 x 10 ⁶	0	6.4 x 10 ⁶	17.3
	2040						8.0 x 10 ⁶	0	8.0 x 10 ⁶	21.6

OCEANSIDE CELL

San Diego	1990	3.5 x 10 ⁶	57,000	17 x 10 ⁶	290,000	630,000	0	150,000	150,000	0.2
	2010						3.4 x 10 ⁶	600,000	4.0 x 10 ⁶	6.3
	2040						17 x 10 ⁶	3.6 x 10 ⁶	20.6 x 10 ⁶	32.7
Del Mar	1990	2.5 x 10 ⁶	36,000	13 x 10 ⁶	180,000	440,000	0	290,000	290,000	0.6
	2010						1.6 x 10 ⁶	1.1 x 10 ⁶	2.7 x 10 ⁶	6.1
	2040						26 x 10 ⁶	3.1 x 10 ⁶	29.1 x 10 ⁶	66.1
Solana Beach	1990	2.0 x 10 ⁶	20,000	10 x 10 ⁶	100,000	300,000	0	340,000	340,000	1.1
	2010						5.5 x 10 ⁶	710,000	6.2 x 10 ⁶	20.7
	2040						33 x 10 ⁶	2.0 x 10 ⁶	35 x 10 ⁶	116.7
Encinitas	1990	6.1 x 10 ⁶	53,000	30 x 10 ⁶	270,000	880,000	0	420,000	420,000	.5
	2010						1.4 x 10 ⁶	1.3 x 10 ⁶	2.7 x 10 ⁶	3.1
	2040						9.8 x 10 ⁶	6.2 x 10 ⁶	16 x 10 ⁶	18.2
Carlsbad	1990	5.9 x 10 ⁶	120,000	29 x 10 ⁶	580,000	1.2 x 10 ⁶	0	480,000	480,000	.4
	2010						4.1 x 10 ⁶	1.5 x 10 ⁶	5.6 x 10 ⁶	4.7
	2040						38 x 10 ⁶	8.4 x 10 ⁶	46.4 x 10 ⁶	38.7
Oceanside	1990	5.4 x 10 ⁶	33,000	27 x 10 ⁶	170,000	710,000	0	640,000	640,000	.9
	2010						4.6 x 10 ⁶	1.3 x 10 ⁶	5.9 x 10 ⁶	8.3
	2040						33 x 10 ⁶	3.3 x 10 ⁶	36.3 x 10 ⁶	51.1
Camp Pendleton	1990	0	0	0	0	0	0	0	0	0
	2010						0	0	0	0
	2040						0	0	0	0
San Onofre	1990	1 x 10 ⁶	0	5 x 10 ⁶	0	110,000	0	30,000	30,000	.3
	2010						0	0	0	0.0
	2040						0	0	0	0.0
Orange County	1990	5.1 x 10 ⁶	39,000	25 x 10 ⁶	200,000	710,000	0	370,000	370,000	0.5
	2010						0	980,000	980,000	1.4
	2040						1.9 x 10 ⁶	8.0 x 10 ⁶	9.9 x 10 ⁶	13.9

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